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PEARL RIVER SHALLOW WATER RESERVOIR WATER QUALITY-RECREATION PROJECT: PREIMPOUNDMENT STUDY

John A. Little

Public Health Service
Atlanta, Georgia

March 1963

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PEARL RIVER SHALLOW WATER RESERVOIR
WATER QUALITY-RECREATION PROJECT

PREIMPOUNDMENT STUDY

by John A. Little

This document reports on the first 18 months of the Pearl River Reservoir Study, including discussion of investigation results for the period January-December, 1962. Progress reports containing additional study data will be published in the future. For proper interpretation of total study results, all reports should be considered as a whole.

U. S. Department of Health, Education and Welfare
Region IV
Public Health Service
Bureau of State Services
Division of Water Supply and Pollution Control
Atlanta, Georgia

March 1963

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INTRODUCTION

AUTHORIZATION

The Pearl River Shallow Water Reservoir Water Quality - Recreation Project was initiated by the Public Health Service (Region IV, Atlanta, Georgia) at the written request (January 13, 1961) of the Mississippi State Board of Health. As requested and with the research needs of the Public Health Service in mind, a study was planned to determine the effect on water quality of a shallow reservoir to be used extensively for recreation. The study has been conducted under the provision of Section 4(a), Public Law 660 as amended (the Federal Water Pollution Control Act). When completed, the Pearl River Reservoir will provide municipal water for the City of Jackson, Mississippi as well as serve as a recreational lake for the surrounding area.

Inasmuch as the reservoir was not completed before the project began, there was opportunity to perform a preimpoundment investigation. This report describes that investigation.

OBJECTIVES AND SCOPE

Objectives of the study have been planned with due regard to both the Mississippi State Board of Health request and the needs of the Public Health Service for research on the effect of recreational uses on water quality in reservoirs. Answers to the following questions are to be sought:

(1) What will be the sanitary quality of the water that will be available for Jackson? Will the bacterial quality be lowered by the anticipated extensive utilization by pleasure boats, the establishment of homes around the shoreline, and swimming? What will be the effect of sanitation regulations used for the reservoir?

(2) Will fuel additives, including lead, used in boat motors be added to the water in significant quantities?

(3) What sources of pollution exist in the upstream drainage area and what will be their effects on reservoir water quality and on recreational usage of the reservoir?

(4) The generally shallow water will create a potential for nuisance algal bloom. What will be the nature and extent of taste and odor problems resulting at the Jackson water plant?

(5) The shallow water may be expected to permit excessive submerged and floating aquatic weed growth that may create favorable mosquito breeding areas. Application of pesticides for control of mosquitoes and nuisance weeds may be necessary. What will be the effects of chemical and decay products (from killed vegetation) on the raw water quality?

(6) What water quality changes will result from decay of organic matter and leaching of minerals from the newly inundated land until the reservoir bottom has become stabilized?

ACKNOWLEDGEMENTS

The very able assistance of the following agencies in the planning and execution of this study is hereby acknowledged:

The Pearl River Valley Water Supply District, Jackson,
  Mississippi
The U. S. Geological Survey, Surface Water Branch, Jackson,
  Mississippi
The City of Jackson Water Department.

Special thanks are extended to the Mississippi State Board of Health for providing space and equipment for the project laboratory and for continuing to provide valuable advice and information.

SUMMARY

(1) At the request of the Mississippi State Board of Health, the Public Health Service Region IV office in Atlanta, Georgia, initiated in the summer of 1961 a continuing water quality study of the Pearl River Valley Reservoir[1] in central Mississippi.

(2) The reservoir will be used primarily for water supply for Jackson, Mississippi and for recreation. Average depth will be eleven feet plus, which is shallow considering the area to be covered by impoundment - 31,000 acres.

(3) The Pearl River Valley Water Supply District, which controls the reservoir, has included in its contract with the City of Jackson the provision that water released from the dam would have essentially the same quality (especially concerning domestic water supply) as existed in the river before impoundment.

(4) The primary purposes of the Public Health Service investigation are to evaluate water quality prior to impoundment and to determine significant quality changes under postimpoundment conditions. Of particular interest will be those changes which might be due to shallow water or recreational uses.

[1] This reservoir has now been officially named "The Ross R. Barnett Reservoir."

(5) This report presents information obtained during the period July, 1961, through December, 1962. The data reflect water quality during preimpoundment conditions. Representative values of various physical, chemical, radiological, and bacteriological water quality characteristics were determined in order to make predictions and/or interpretations relating to the effect of Pearl River Reservoir Development.

(6) In addition to the quality data obtained, information was also collected on climatological and hydrological conditions, physical features of the area to be inundated, and sources and extent of municipal and industrial pollution in the contributing watershed.

CONCLUSIONS

(1) The preimpoundment phase of the Pearl River Reservoir water quality project has provided an extensive background of useful information which may be compared with postimpoundment conditions. Characteristics measured include most of the major physical, chemical, and bacteriological elements descriptive of sanitary water quality.

(2) Analytical results obtained indicate that water quality at the main damsite sampling station (Station 1; Figure 3) on the Pearl River is well suited for domestic and industrial water supply, contingent upon the use of conventional treatment methods. Bacteriological quality of the water at this station was within the 5000 MPN per 100 ml level considered acceptable for raw waters provided complete treatment consisting of coagulation, rapid sand filtration, and chlorination, or its equivalent.

(3) The City of Jackson water treatment plant, located approximately five miles downstream from the dam, consistently produces a water which meets the 1962 Public Health Service Drinking Water Standards. Treatment provided at the plant includes coagulation, sedimentation, filtration, activated carbon application, pH control, and chlorination.

(4) Streams tributary to the reservoir (Stations 2, 3, and 4; Figure 3) had generally the same water quality as did the main stem of the Pearl River at the dam. The effects of watershed pollution sources on tributary stream quality was detectable at times but generally not serious. Water quality at Station 4 (Pelahatchie Creek) showed the most pronounced effects of pollution (dissolved oxygen content sometimes less than 4.0 milligrams per liter).

(5) Bacteriological quality at the four sampling stations was found unacceptable for water contact sports. Average coliform MPN[1] per 100 milliliters exceeded the 1000 level generally accepted in the United States and Canada as a reasonable standard for water contact sports. Refined techniques of bacteriological examination indicated that much of the bacterial content was of fecal origin.

(6) The total population equivalent of wastes, both treated and untreated, discharged into reservoir tributaries is approximately 30,000. Progress towards providing adequate treatment (generally in waste stabilization ponds) is such that most municipal and industrial wastes will receive some treatment prior to final filling of the reservoir.

(7) While some water quality changes such as turbidity and bacterial reduction and temperature stabilization may be expected to result from impoundment, it is difficult at this time to make further predictions, i.e., algal growth potential, manganese content increase, etc.

[1] MPN - most probable number.

RECOMMENDATIONS

It is recommended to agencies responsible for control of water quality in the Pearl River Reservoir:

(1) that sanitation regulations be adopted and enforced;

(2) that the program for treatment of municipal and industrial wastes in the reservoir watershed be continued; and

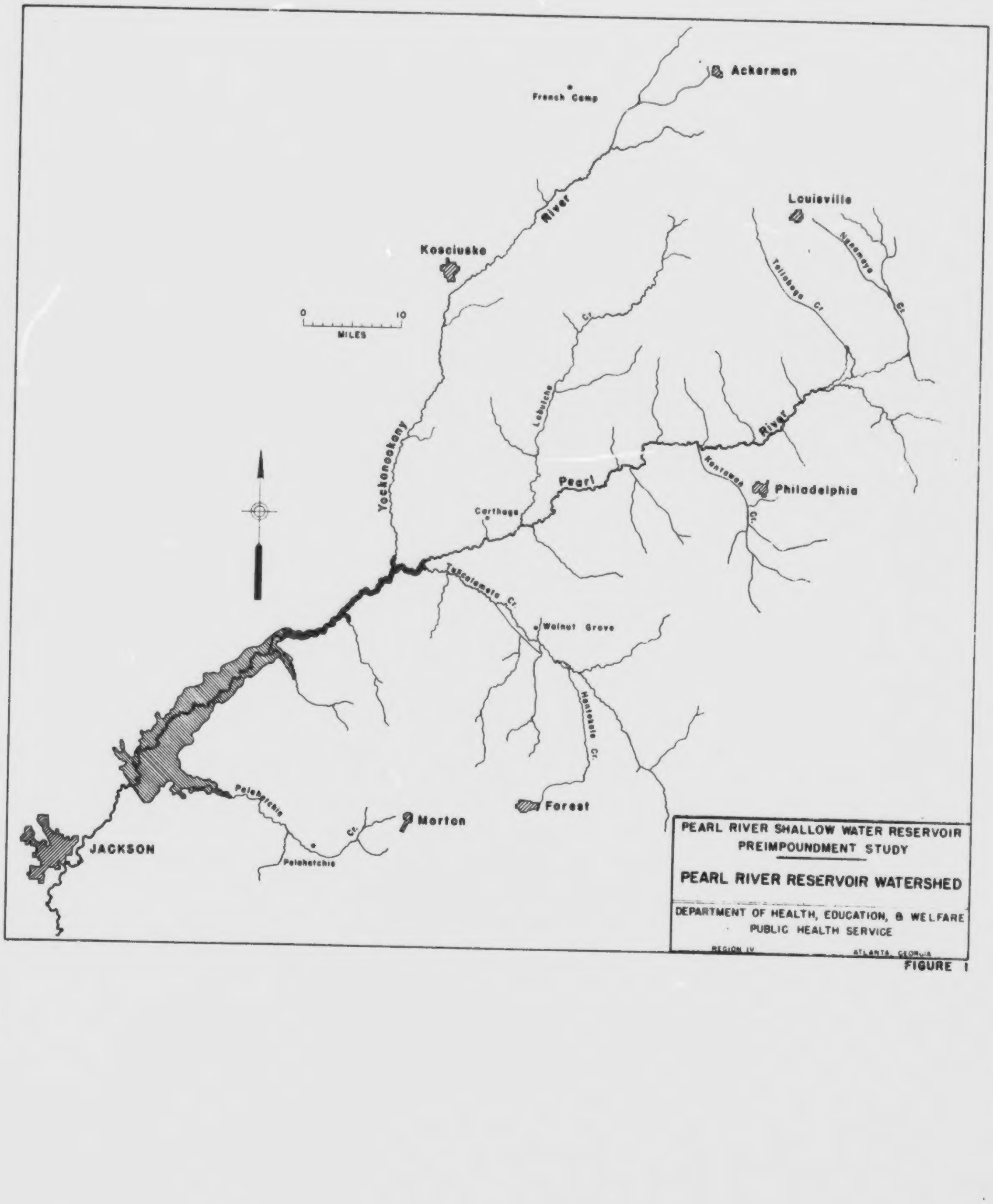
(3) that infestation of water hyacinths, alligator weeds, and other nuisance weeds be prevented.

GENERAL BACKGROUND

Formulation of the Pearl River Water Supply District was a first in Mississippi history - resulting from the Pearl River Valley Water Supply District Act (Appendix A) passed by the State Legislature in 1958. The District formed consists of an impoundment, the Pearl River Valley Reservoir, and a circumferential watershed control area. At its closest point, the District is approximately three miles northeast of Jackson, Mississippi. (See Figure 1.) Reservoir waters are impounded by a three mile long, earth fill, concrete spillway structure (Figure 2). From the dam to the headwaters is a distance of approximately 43 miles, and the 31,000 acres inundated will include portions of Hinds, Rankin, Madison, Scott, and Leake Counties. The Reservoir is located in a Gulf coastal section where the land is gently rolling and swampy near watercourses. Maximum depth of the impoundment at the dam will be 40 feet, and average depth will be slightly in excess of 11 feet. There will be large areas of shallow water.

According to the 1958 Act, the District is "to construct, own and operate reservoirs and dams to insure adequate water supply for domestic, municipal, commercial, industrial, agricultural and manufacturing purposes, and recreational uses; ....to perform, and to assist and cooperate with agencies of the federal government or of the state or any political subdivision thereof in performing water conservation, flood control, pollution abatement, timber conservation, and irrigation work; ...."

9a


Ackerman
French Camp
River
Kosciusko
Louisville
Nanamaya Cr.
Tallahaga Cr.
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10
MILES
Lobutcha
Cr.
Yockanookany
River
Pearl
Carthage
Kentawka
Philadelphia
Cr.
Tuscolameta Cr.
Walnut Grove
Hontokalo Cr.
Pelahatchie
Cr.
Pelahatchie
Morton
Forest
JACKSON

PEARL RIVER SHALLOW WATER RESERVOIR
PREIMPOUNDMENT STUDY

PEARL RIVER RESERVOIR WATERSHED

DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION IV ATLANTA, GEORGIA

FIGURE 1

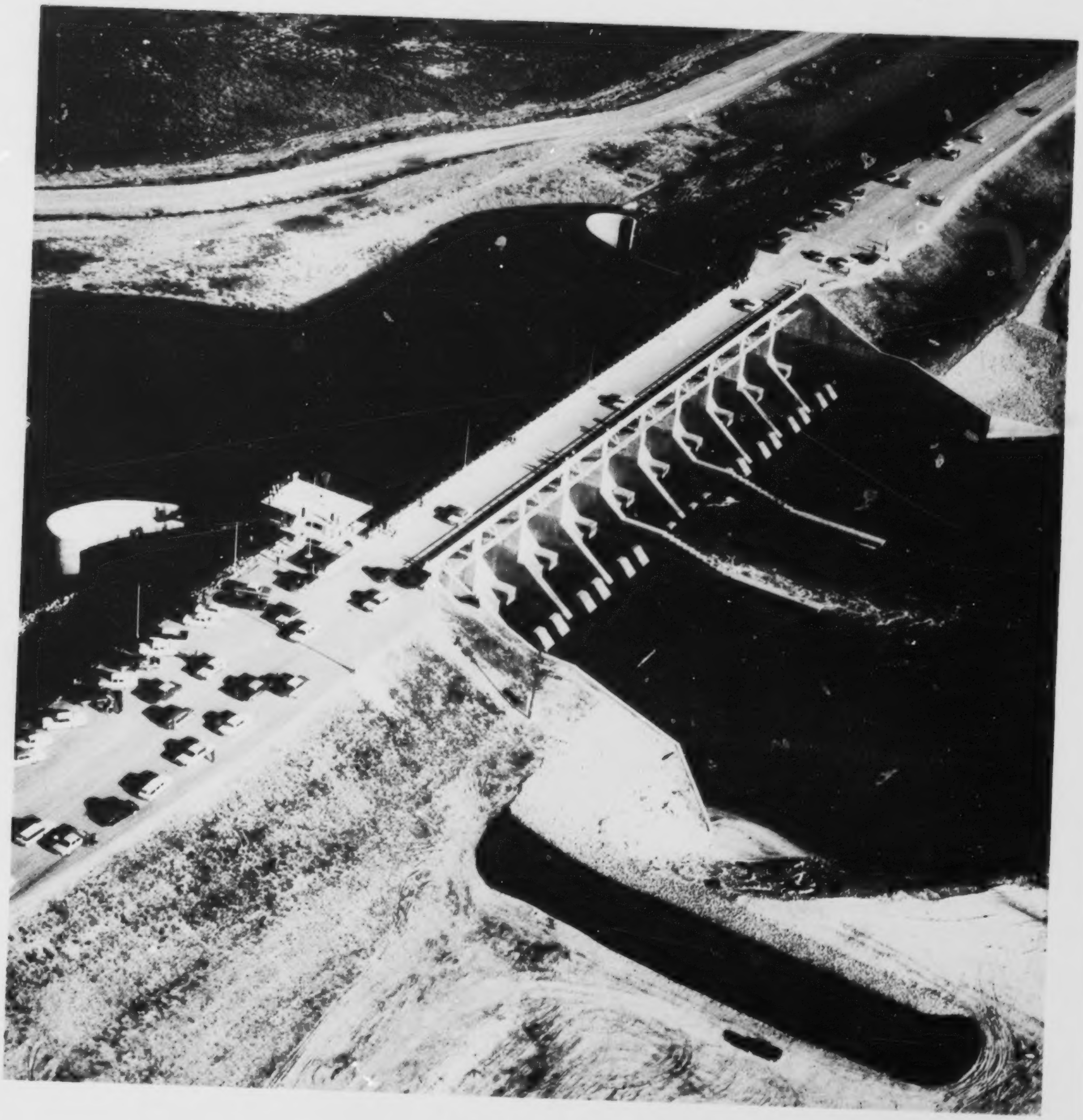


FIGURE 2
PEARL RIVER RESERVOIR DAM

Under the water supply provision in the Act, the Pearl River Valley Water Supply District contracted with the City of Jackson to furnish water from the reservoir. Stipulated in the contract, which is contained in toto in Appendix B, were certain agreements concerning the quality of water delivered to the City. Essentially, the District promised that water released from the dam would have the same quality, especially from the standpoint of domestic water supply, as existed in the river before impoundment. Water released is not to be more difficult or costly to treat, is not to present a greater hazard to health, and is not to have substantially higher color, taste, and odor values. In addition to the statements in this contract, the engineers' Project Planning Report to the District says that silt content, hardness, and pollution of water taken from the reservoir will all be less than present maximums due to the settling and diluting effect of the lake.

Although dependable water supply was a major justification for the reservoir project, its successful promotion was due primarily to the proposed recreational benefits to be provided for the citizens of Mississippi. By the twentieth year of operation, it is predicted that 5,000 boat permits will be sold annually, and that there will be 1,200,000 fisher-man days and 825,000 park visits annually. The potentially detrimental effects of such extensive recreational usage on a shallow reservoir to be used as a municipal water supply source is a matter of concern to the Public Health Service.

STUDY REQUEST

The January 1961 request to the Public Health Service mentioned the need for determining "what must be done in construction and maintenance to assure water quality suitable for domestic purposes." It was also suggested that such a study might provide guidelines for future control of similar projects in Mississippi.

During the summer of 1961, preparations were begun to initiate the first phase of the study - the preimpoundment phase (or existing water quality phase). By January 1962, the laboratory was operative, and water quality data began to accumulate. The plan for the preimpoundment phase called for a period of study of approximately eighteen months, which meant termination by July 1963. The major bulk of water quality basic data was to be collected during the period January through December, 1962. The last six months of the study were scheduled for special studies such as carbon filter sampling technique and effects of limited impoundment on water quality. As needed, supplemental basic data will also be obtained during the final phase of the preimpoundment study.

Only the January through December study period will be discussed in this report.

METHODS OF STUDY

SAMPLING

After a thorough field reconnaissance was completed in the summer of 1961, it was determined that four permanent sampling stations (see Figure 3) would be needed to obtain preimpoundment water quality data. At these four stations, water samples were collected and analyzed to obtain data on both water entering and leaving the proposed impoundment area. Three major streams enter the reservoir area: Pearl River and Yockanookany River from the north and Pelahatchie Creek from the east. The latter tributary is a small stream (average eight year discharge 200 cfs) but it has the highest ratio of waste water flow to natural streamflow of the three influent streams. Long-term average discharge in the other two influent rivers at sampling station sites is 2600 cfs for the Pearl and 650 cfs for the Yockanookany.

A fourth sampling station was located near the recently completed dam. Water quality information indicative of water leaving the reservoir area was obtained at this station. During the year this sampling site was relocated several times because of interference from construction and inclement weather conditions. However, the data are uniform and are considered representative of a single permanent station.

For purpose of the preimpoundment study the four sampling stations were designated as follows:

Station 1 - Pearl River immediately below the dam site,

Station 2 - Yockanookany River at State Highway 16 bridge,

FIGURE 3
SEE FOLDOUT IN BACK OF REPORT.

Station 3 - Pearl River at State Highway 13 bridge, and

Station 4 - Pelahatchie Creek at State Highway 471 bridge. In all probability these same sampling sites will also be utilized during the impoundment phase of the study.

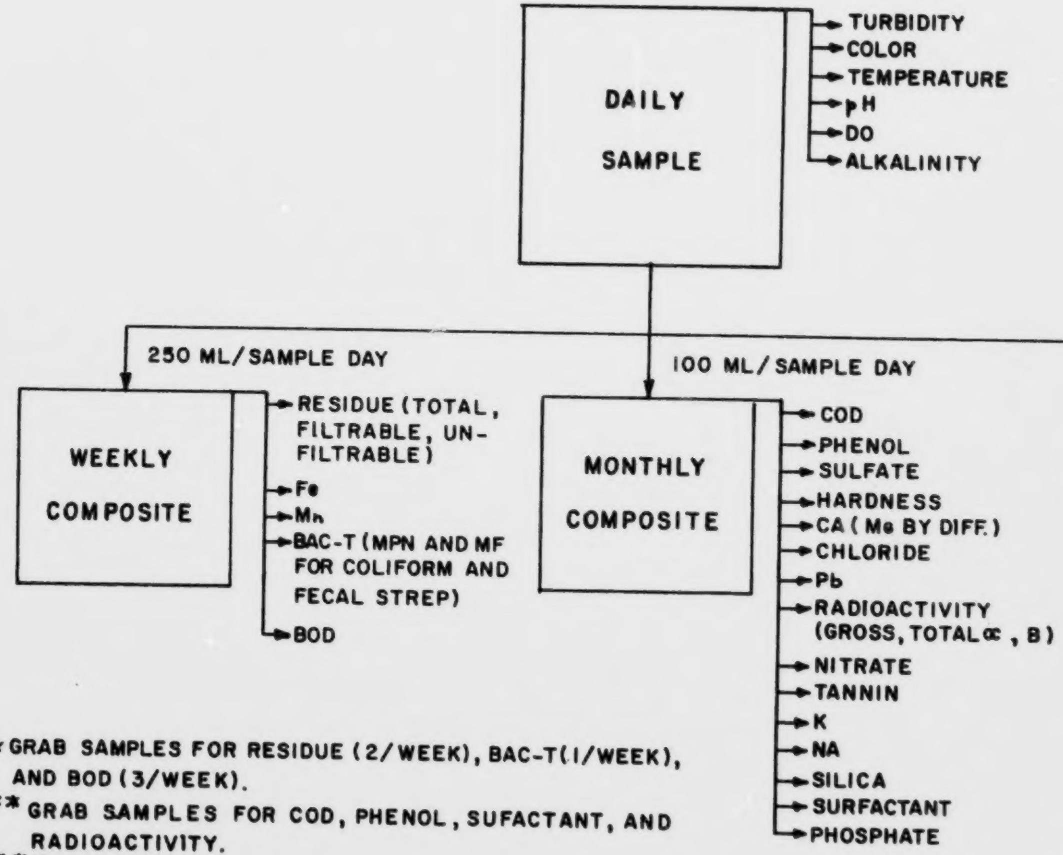
Although use of continuous sampling devices was considered initially, this was eventually ruled out because of anticipated servicing problems, initial cost, possible vandalism, and the need for actual observations of stream conditions when samples were taken. A daily collection program was established to supply the major bulk of samples for analysis. The disadvantages of analyzing grab samples to obtain representative knowledge of water quality conditions were mitigated by varying the collection schedule and supplementing the daily routine with special 24-hour studies. These special studies generally pertained to diurnal changes in the common characteristics dissolved oxygen (DO), biochemical oxygen demand (BOD), and various bacteriological elements.

Typically, a daily sampling run consisted of a 125-mile trip with four station stops. Since streamflow was well mixed at the sampling stations (transverse sampling showed negligible quality variations), midstream samples were obtained from bridges. A water displacement-type sampler (DO Dunker) with two-BOD bottle capacity and separate attachment for bacteriological sampling was utilized. All samples were placed on ice in the dark as soon as collected for preservation purposes.

During the latter part of the year DO and alkalinity analyses were performed in the field; water temperature and stream stage (Stations 3 and 4 only) also were recorded in the field. Wire-weight gauges were installed and stage-discharge curves furnished for Stations 3 and 4 by the U. S. Geological Survey Surface Water Branch in Jackson.

LABORATORY DETERMINATIONS

Prior to the inception of the intensive preimpoundment study period (January through December, 1962) various analytical schemes were devised for depicting water quality conditions. It was decided that analysis information should be obtained regarding practically all of the physical, chemical, and bacteriological characteristics of water for which limits have been established. (These limits are chiefly those found in the 1962 Public Health Service Drinking Water Standards.) In addition to examinations of the above type, analyses were made for other common water quality characteristics such as hardness, calcium, phosphate, etc. Although the analysis schedule was re-evaluated at intervals and routines altered, the schedule as shown in Figure 4 is representative of the study year. With few exceptions, analyses were performed according to the Eleventh Edition of Standard Methods for the Examination of Water and Wastewater, 1960. Sulfate determinations and certain of the bacteriological examinations were performed according to techniques established by the Public Health Service Sanitary Engineering Center, Cincinnati, Ohio. These are outlined in Appendix C.


DAILY SAMPLE
TURBIDITY
COLOR
TEMPERATURE
pH
DO
ALKALINITY
250 ML/SAMPLE DAY
WEEKLY COMPOSITE
RESIDUE (TOTAL, FILTRABLE, UN-FILTRABLE)
Fe
Mn
BAC-T (MPN AND MF FOR COLIFORM AND FECAL STREP)
BOD
100 ML/SAMPLE DAY
MONTHLY COMPOSITE
COD
PHENOL
SULFATE
HARDNESS
CA (Mg BY DIFF.)
CHLORIDE
Pb
RADIOACTIVITY (GROSS, TOTAL α, β)
NITRATE
TANNIN
K
NA
SILICA
SURFACTANT
PHOSPHATE
10 ML/SAMPLE DAY
SEMIANNUAL COMPOSITE
F
Sc
As
Cu
SILICA
Cr

*GRAB SAMPLES FOR RESIDUE (2/WEEK), BAC-T (1/WEEK), AND BOD (3/WEEK).

** GRAB SAMPLES FOR COD, PHENOL, SUFACTANT, AND RADIOACTIVITY.

*** GRAB SAMPLES FOR HEXAVALENT CHROMIUM (1/MONTH).

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 4
ANALYSIS SCHEDULE

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REGION IV ATLANTA, GEORGIA

It will be noted from Figure 4 that composite samples were utilized to a great extent. The reasons for compositing were threefold: (1) there was insufficient personnel and time available for performing comprehensive laboratory analyses on each sample collected; (2) analysis of composites provides a satisfactory long-term picture of waters whose composition varies little (analyses made during the latter part of 1961 indicated minor day-to-day changes); and (3) the cost for complete daily analyses is high. Various methods of preservation of composites, again according to Standard Methods, were employed. Depending on the type of laboratory examination to be made, special sample containers, refrigeration, acidification, chloroform treatment, or a combination was used for preservation. In spite of precautions taken to maintain samples in an unaltered state, some deterioration was anticipated. Grab samples were, and will be increasingly, examined to validate results obtained from composites. Corroboration is especially needed for the monthly phosphate and nitrate analyses.

SOURCES OF HYDROLOGICAL AND OTHER DATA

In order to compare water quality variations with streamflow, discharge records at Stations 1 and 2 were obtained routinely from the U. S. Geological Survey in Jackson. In addition, the Pearl River Water Supply District financed installation (by the U. S. Geological Survey) of wire-weight gauges at Stations 3 and 4.

Unfortunately, these gauges were not available until the latter part of the year. Nevertheless, reasonable estimates of the average monthly flow contributed to the flow total at Station 1 by the streams at Stations 3 and 4 can be calculated by difference.

Another use of the stream discharge data, aside from comparison with quality variations, is for calculation of weighted averages. Such averages provide a better understanding of the amount of suspended solids, hardness, iron, silica, etc. entering and leaving the reservoir area under preimpoundment conditions. Data on weighted average values will be presented in supplemental reports.

Other data which were collected for the study included: (1) hardness and alkalinity measurements made at the Jackson Water Works, and (2) information concerning sources of municipal and industrial wastes in the Pearl River Reservoir watershed. Data collected at the city water works were compared with study results for Station 1. The water works is located approximately five miles downstream from the dam. Limited data concerning other water quality characteristics, e.g., iron and manganese, were also obtained from the water plant and compared with Station 1 results.

Throughout the year, field trips were made to all municipalities and industries discharging liquid wastes into tributaries of the reservoir. Pertinent information concerning volume, type, and strength of wastes as well as degree and effectiveness of treatment provided was collected on inventory forms. The inventories are maintained current from information supplied by the Division of Sanitary Engineering, Mississippi State Board of Health. Actual comprehensive laboratory analyses of municipal and industrial waste sources were not obtained due to the limited time, staff, and funds available. Such data would probably not be needed since the major portion of wastes entering the watershed are removed from the reservoir boundaries and receive sufficient treatment to insure recovery of receiving streams before they near the reservoir. Pelahatchie Creek (Station 4), however, does receive proportionately large amounts of untreated municipal and industrial waste (poultry processing) which detrimentally affect the stream during periods of low flow.

STUDY RESULTS

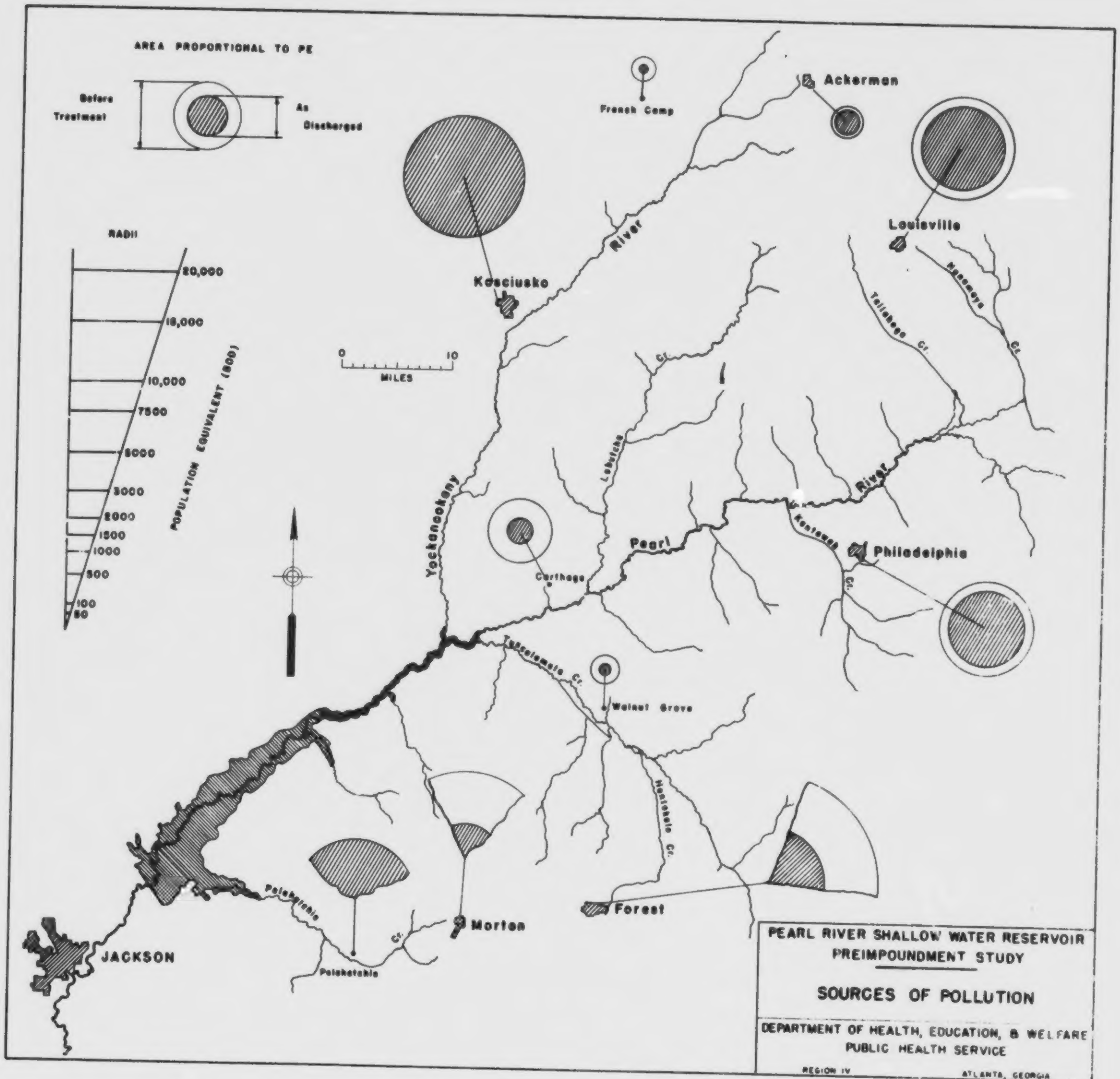
SOURCES OF POLLUTION

Information concerning municipal and industrial waste sources are summarized below by location. Figure 5 illustrates estimated relative strengths of these sources before and after treatment as well as indicating their location with respect to proximity to the Pearl River Reservoir.

1. Louisville, Mississippi

This town provides primary treatment at a plant on the south side of town for approximately 4,800 persons. The only appreciable industrial waste discharged to the municipal sewerage system originates at the Winco Dairy. However, this dairy is relatively small and serves only the immediate vicinity. The municipality at present has no future plans concerning expansion or alteration of their present plant. BOD removal efficiency is estimated as 35 percent. Population equivalent (PE) discharged is 3100.

In addition to the municipal wastes, the American Creosote Works, Inc. discharges its waste into a small creek near the municipal treatment plant. The effluent from this industry which consists of liquids discharged from boilers and from wood vacuum-cooking operations, receives some settling before discharge. Only an insignificant portion of creosoting process waste reaches the receiving stream. The plant employs 128 persons, and plant operation is continuous throughout the year.


AREA PROPORTIONAL TO PE
Before Treatment
As Discharged
RADII
20,000
15,000
10,000
7500
5000
3000
2000
1500
1000
500
100
50
POPULATION EQUIVALENT (BOD)
0
10
MILES
French Camp
Ackerman
Louisville
Kosciusko
River
Tallahaga Cr.
Nanawaya Cr.
Cr.
Lobutcha
Yockanookany
Pearl
River
Kentawka Cr.
Philadelphia
Carthage
Tuscolameta Cr.
Walnut Grove
Hontokalo Cr.
Pelahatchie Cr.
Pelahatchie
Morton
Forest
JACKSON

PEARL RIVER SHALLOW WATER RESERVOIR
PREIMPOUNDMENT STUDY

SOURCES OF POLLUTION

DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION IV ATLANTA, GEORGIA

FIGURE 5

Louisville is located on the headwaters of the Pearl River approximately 70 stream miles above the Pearl River Reservoir.

2. Philadelphia, Mississippi

This municipality has a relatively old primary treatment plant (Imhoff tank) which discharges treated effluent to Kentawah Creek approximately 41 stream miles above the Pearl River Reservoir. Kentawah Creek is a tributary of the Pearl River. The PE of raw wastes reaching the plant is estimated at 4,000, and it is also estimated that treated effluent has a PE of 2,600. There are no major industrial waste sources connected to the municipal sewerage system.

A new waste stabilization pond to serve 750 to 1,000 people (presently in unsewered area) is proposed for the west Philadelphia area.

An 80-bed hospital located near the town discharges its liquid wastes to a one-acre lagoon.

A new three-acre lagoon is currently under construction to serve the new plant of U. S. Motors, Inc. The pond will receive sanitary wastes from the factory primarily.

During the past year the DeWeese Lumber Company was fined for causing a fish kill in the Pearl River. Waste resulting from the company's creosoting operations are discharged into an intermittent stream. Ordinarily, the wastes do not reach the Pearl River. However, during periods of heavy rainfall the creek is frequently flushed out and phenolic waste components enter the Pearl River in a large concentration. Inasmuch as the creosote operations at the lumber company are somewhat variable, no estimate has been made of waste strength. It is essential that precautions be taken in the future to prevent the discharge of phenolic type wastes if objectionable tastes and odors in Jackson's water supply are to be avoided.

The Choctaw Indian Reservation surrounds the Philadelphia area. Major waste sources in the Reservation area are the Redwater and Pearl River Schools with enrollments of 100 and 200, respectively. Treatment in waste stabilization ponds is provided for all sanitary wastes originating at these schools.

3. Carthage, Mississippi

A newly constructed 25-acre waste stabilization pond serves the municipality of Carthage. The town has a sewered population of 1,900 and little if any industrial waste. The outfall from the lagoon is located approximately one mile from the Pearl River and seven miles from the reservoir. Assuming 85 percent treatment efficiency, treated waste has a PE of 280.

4. Forest, Mississippi

Forest has a sewered population of 4,000, one-third of which discharge waste to a stabilization pond located in the southeast section of town. Four poultry processing plants - Southeastern Poultry (200,000 to 450,000 birds per week), Forest Packing Company (130,000 birds per week), Gaddis Packing Company (115,000 birds per week) and Cudahy Packing Company (150,000 birds per week) - also discharge their wastes to this lagoon. A lagoon has been constructed to serve the north and east portions of Forest, but the treatment being effected has not been thoroughly evaluated.

Both treated and untreated wastes are discharged to Hontokalo Creek, thence to Tuscalameta Creek, and then into the Pearl River a short distance above the upper reservoir boundary (total stream distance traveled is approximately 32 miles). PE discharged to the receiving stream is estimated at 4800.

A new plant of the Sunbeam Manufacturing Company will provide a small lagoon for neutralization of acid and caustic wastes.

5. Walnut Grove, Mississippi

A lagoon has been constructed recently to treat the wastes from this small municipality. The sewered population, all of which is served by the new lagoon, is approximately 400. The receiving stream is Tuscalameta Creek, and the distance to the reservoir is approximately 18 stream miles. Estimated PE discharged is 60.

6. Ackerman, Mississippi

This municipality with a sewered population of 422, has recently completed construction of a primary treatment plant. There are no major sources of industrial waste. Ackerman is located on the headwaters of the Yockanookany River some 62 stream miles above the reservoir.

There has been some discussion recently concerning the addition of a secondary treatment unit to the present primary plant.

7. French Camp Academy

This private school located on a tributary of the Yockanookany River (50+ miles above the reservoir) has a resident population of 225. All wastes originating from the school are treated in a waste stabilization pond of adequate capacity.

8. Kosciusko, Mississippi

At the present time the town of Kosciusko does not treat its wastes. However, construction of two waste stabilization ponds to serve the municipality, and its associated industries is expected to begin soon. The total sewered population of the town, which is now 6,800, will be served by these lagoons.

Major industrial waste sources are Lu Vell Dairy Products (PE 50), Pet Dairy Products Company (PE 70), Kankote, Inc., Kosciusko Hosiery Mill, and Mississippi Oil Mill. The total PE from all industries, according to the preliminary engineering report on proposed sewage treatment facilities, is 260.

Kosciusko is located on the Yockanookany River approximately 28 miles above the reservoir.

9. Morton, Mississippi

This town discharges its wastes to a stabilization pond. Effluent from this pond enters Pelahatchie Creek approximately 20 miles above the Pearl River Reservoir. The lagoon serves a sewered population of approximately 1,700 and, in addition, receives industrial wastes from two poultry processing plants and a dairy. One of the poultry plants, Rogers and Son Poultry Processing Company, processes 400,000 birds per week. The treated effluent is estimated to have a PE of 2000.

10. Pelahatchie, Mississippi

Pelahatchie is located on Pelahatchie Creek approximately 12 miles above the reservoir. An effort to obtain funds for construction of waste treatment facilities (lagoon) was defeated in a recent bond election. The town has a sewered population of approximately 500 and also has one large poultry processing company, the Pelahatchie Poultry Company. This plant handles approximately 175,000 birds per week. If the present plans for waste treatment are fulfilled, a one-acre anaerobic lagoon will serve the poultry plant, and a 16-acre aerobic lagoon will receive both wastes from the town and effluent from the poultry plant lagoon. PE presently discharged is estimated as 6500.

11. Other Sources of Waste

The remainder of the municipalities within the Pearl River Reservoir Watershed are considered unimportant from the standpoint of contribution of pollution. Most homes in these towns presently have septic tank systems, usually on an individual home basis. Although ground water supplies may be contaminated in the immediate vicinity of some of these septic tanks, the amount of seepage into surface streams is insignificant.

Some isolated industries are also located in the watershed, but these, too, are considered insignificant from the standpoint of overall pollution contribution.

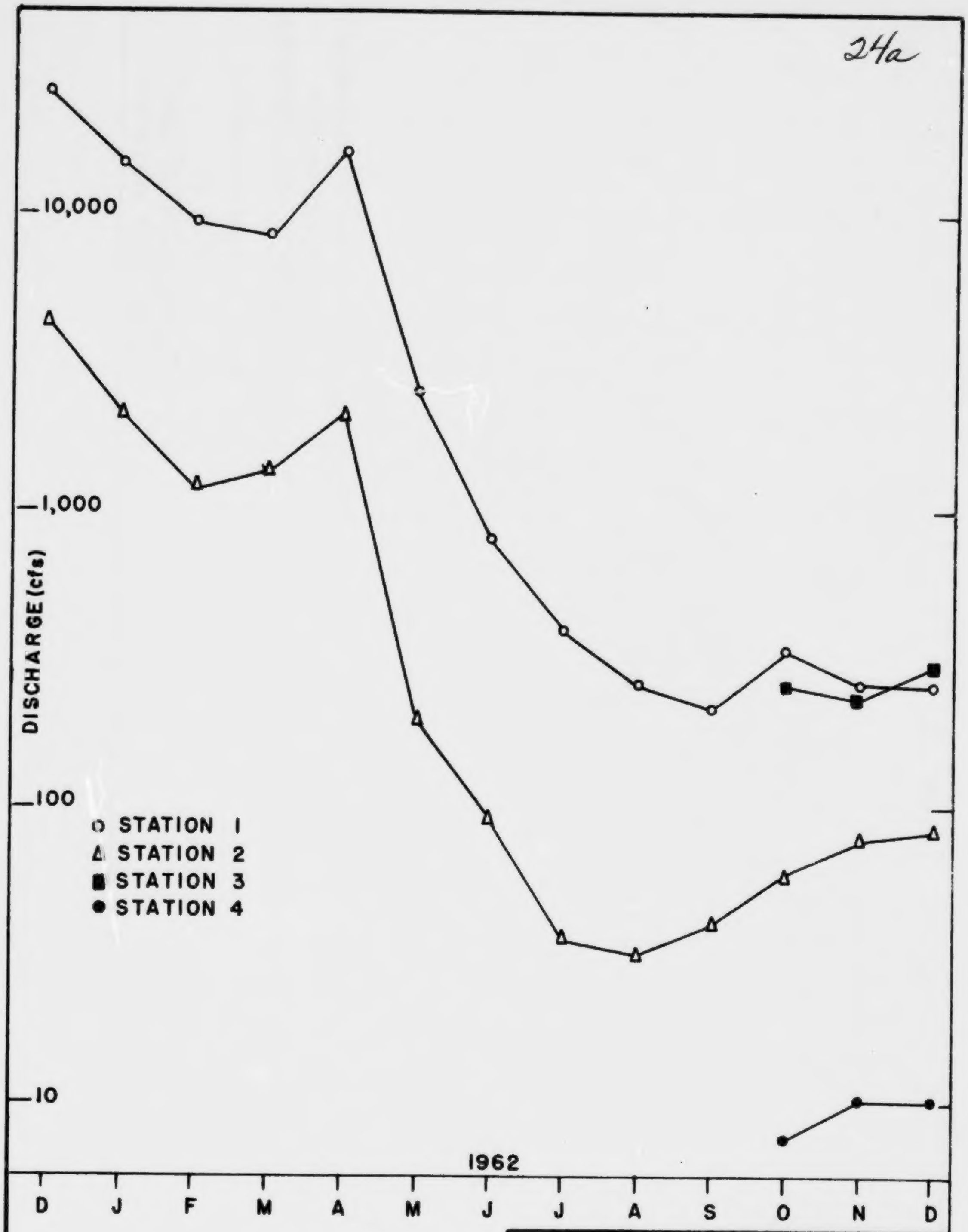
SUMMARY OF HYDROLOGICAL AND CLIMATOLOGICAL CONDITIONS

Variations in streamflow and weather during the year provided an excellent opportunity to study water quality under extreme situations. During the winter months, record-breaking floods occurred on practically every stream in the central area of Mississippi. In addition, uncommonly cold weather was prevalent on many days. During the summer and fall, a prolonged drought extended over a period of several months. Air temperature maximums in the hottest weeks exceeded 95°F more often than not. It is doubtful that a better period for study could have been selected over the past several years.

Average monthly stream discharge for the year at Stations 1 and 2 are shown in Figure 6a. Average flows from October through December for Stations 3 and 4 are also shown. The average discharge at Station 3 is approximately the difference between flows at Station 1 and Station 2. Contribution from Pelahatchie Creek (Station 4) was inconsequential during the major part of the year. During December, total mean streamflow at Stations 2 and 3 exceeded that at the dam due to initiation of limited impoundment.

As would be expected, daily flow fluctuations (Figure 6.b.) in the Yockanookany tributary were more pronounced than at Station 1. In the dry period which extended from late June to December, flows in streams were sustained primarily from ground water infiltration. Water quality characteristics during the low flow months showed some changes that were due to this infiltration.

In the reservoir watershed, the percentage of expected precipitation from January through December varied from approximately 160 percent in January to 35 percent in July. The Weather Bureau station at the airport in Jackson reported a total rainfall deficit



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 6A
MEAN MONTHLY STREAMFLOWS

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FIGURE 6B

DAILY STREAM DISCHARGE

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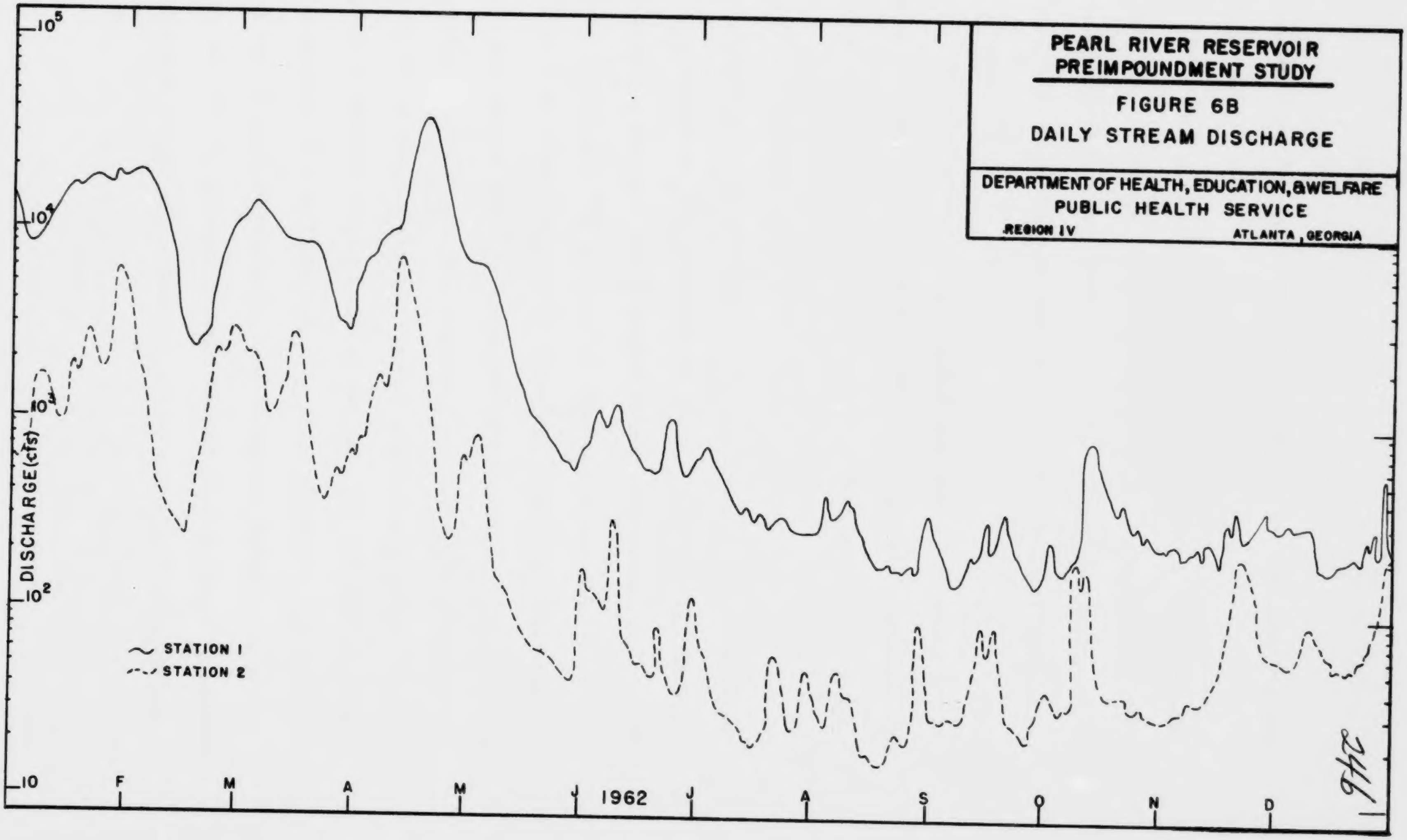

of almost five inches, 31 percent of normal, for the June through October period.

Amounts of precipitation reported at Jackson are shown in Figure 6.c. (Average annual precipitation at Jackson is 51 inches). Because of the drought, four of the five counties bordering on the Pearl River Reservoir were made eligible for livestock feed assistance.

In spite of the climatological extremes of flooding in the winter and drought in the summer and fall, the yearly average for precipitation and temperature in the watershed was nearly normal.

ANALYTICAL RESULTS - DAILY

General - Daily variations in temperature, pH, color (true color), turbidity, dissolved oxygen (DO), alkalinity and BOD for all sampling stations are discussed below. Generally, temperature values ranged with the seasons; pH remained in the neutral zone (6.5 to 7.5); true color varied from less than 10 to more than 75 units and was not usually higher during low flow periods; turbidity concentrations rose and fell between 2 and 400 units depending on the extent of surface runoff; oxygen saturation exceeded 100 percent at several stations during the year and declined to a low of 26 percent (2.0 mg/liter) on July 30 at Station 4; alkalinity, which was determined routinely only during the latter part of the year, was usually measured between the extremes of 9 and 34 mg/liter at Stations 1 - 3, and between 33 and 85 mg/liter on Pelahatchie Creek.

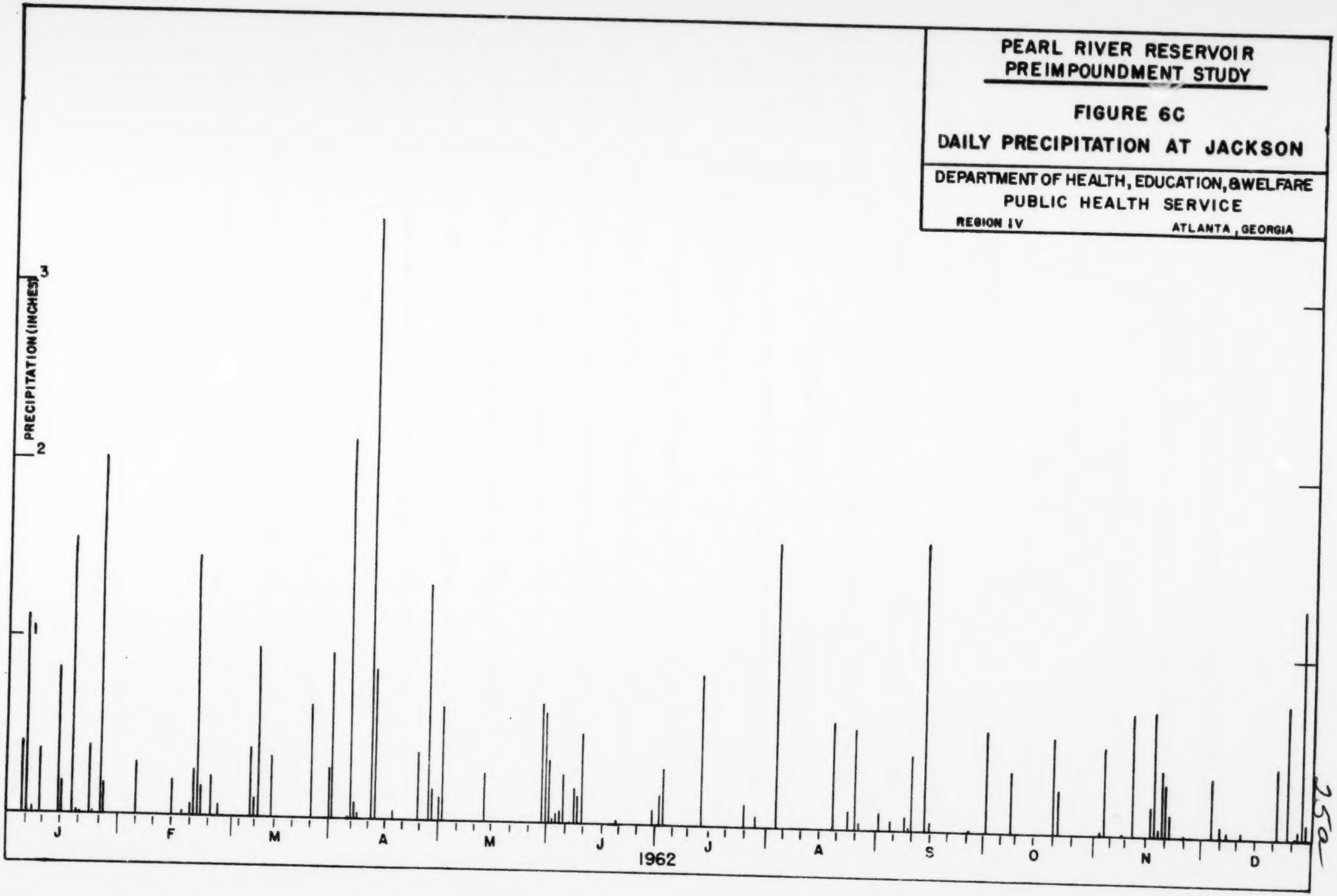

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FIGURE 6C

DAILY PRECIPITATION AT JACKSON

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A more detailed statistical discussion for various characteristics measured daily may be found in Appendix D. Included in the discussion are pictorial representations of frequency distribution curves for temperature, pH, turbidity, and DO.

Temperature - Daily temperature readings at all stations were practically identical. It might be expected that the larger volumes of water at the two stations on the Pearl River would warm or cool more gradually than the two smaller streams, but this was not entirely evident. Minimums of 4° or 5°C were recorded during January and March, and maximums of 30° to 33° during the late summer. Figure 7.a. illustrates annual temperature variations at the Yockanookany River station.

pH - The majority of pH values obtained were slightly acidic (6.5 to 6.9) except possibly for Station 4 which reported more results in the alkaline range. Seasonal variations, and consequently effects of varying streamflow, were minor at most stations. Station 4 results did show a gradual rise in pH from January to December. All pH measurements were made under laboratory conditions as it was determined that no changes occurred between time of sampling and arrival at the laboratory.

In order to make valid comparisons for pH at the damsite before and after impoundment, a standard deviation was calculated. The computed deviation was 0.32

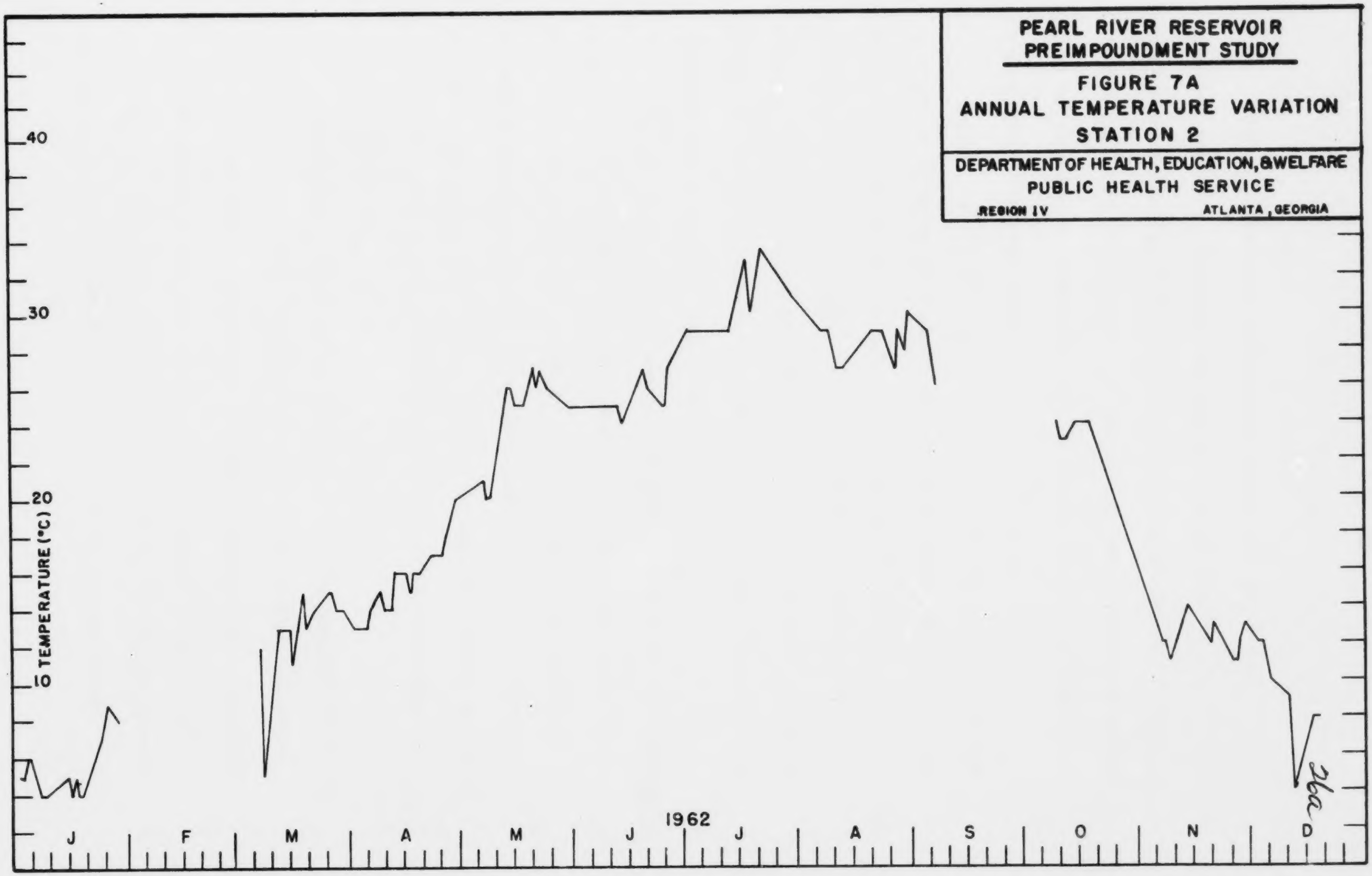

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FIGURE 7A
ANNUAL TEMPERATURE VARIATION
STATION 2

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Figure 8 displays probability curves for pH at each sampling station. Although the curves display similar shapes and are nearly identical within the 10 percent to 95 percent range, outer values are dissimilar. As additional water quality examination results become available, the curves will probably correlate better over the total range.

Color - Although true color results as low as 10 units and as high as 75 units were recorded, the mode value occurred within the range of 40 to 50. Results less than the 20 unit value recommended in the Drinking Water Standards were infrequent. However, water produced for the City of Jackson at its filtration plant has no noticeable color. This indicates that color-causing elements are removed by conventional treatment.

In the discussion of monthly analysis results in a following section, tannin-like compounds, which frequently are associated with color in water, are shown to have a direct relationship to stream discharge. Color analysis data show no such relationship and were generally found to be fairly constant throughout the year. Additional results are needed for a more thorough evaluation of annual variations.

Turbidity - When stream discharges reached maximum peaks in January and April 1962, maximum turbidities exceeding 100 units were also recorded. Comparable turbidity peaks between stations occurred early in the year when general coverage rainfall was prevalent. Individual station peaks occurring during the summer months usually resulted from limited coverage thunderstorms.

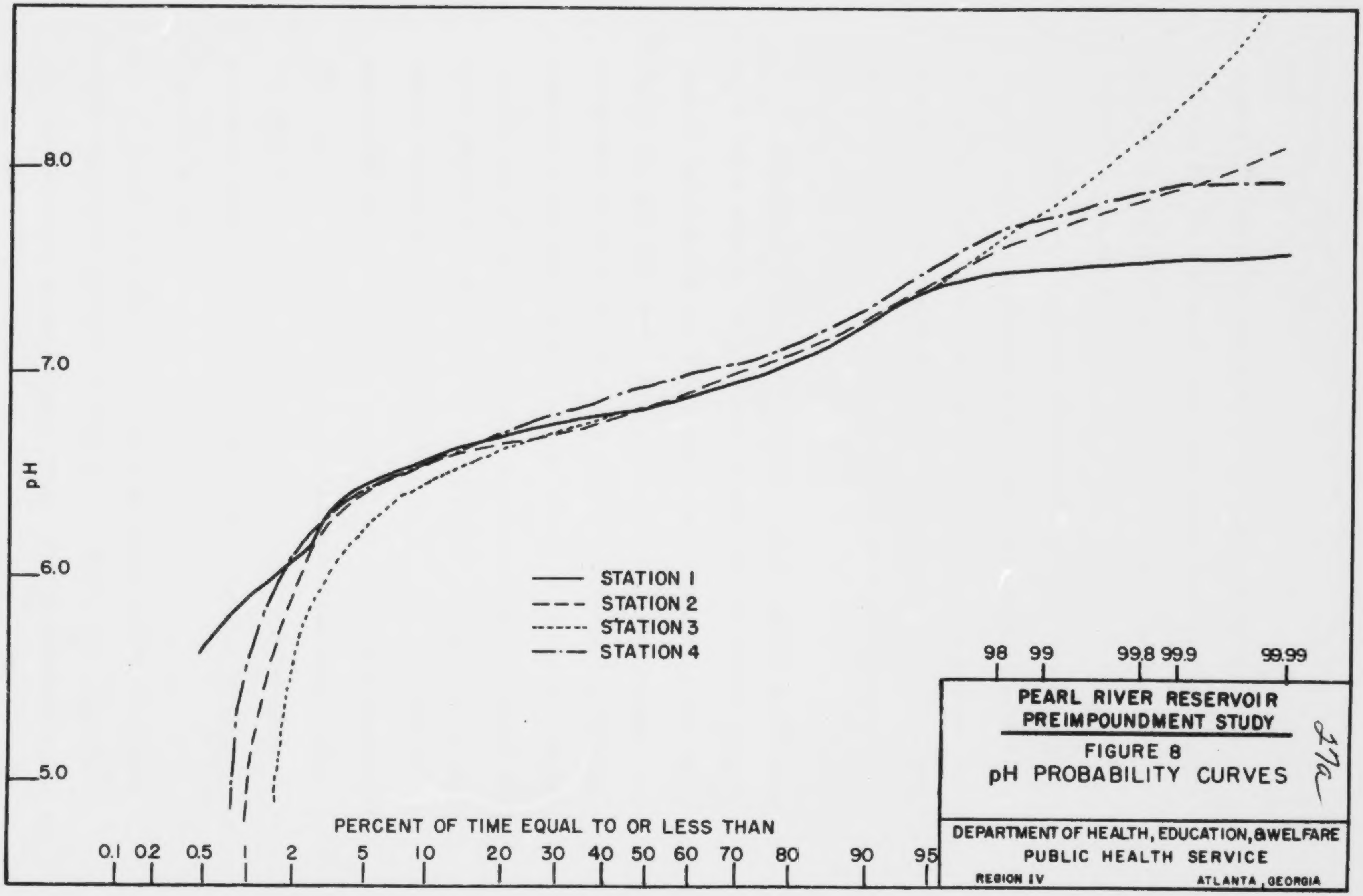

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FIGURE 8
pH PROBABILITY CURVES

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Figure 9.a. shows the relation of turbidity to stream discharge at Station 1. The extremely sharp peak which developed on June 20 was due to construction activities at the dam. Values shown in Figure 9.a. ranged from 5 to 300 units.

Additional turbidity measurements will be obtained for all stations in order to define more closely the range of values occurring during high runoff periods. However, the probability of occurrence graph (Figure 9.b.) for turbidity shows little scatter in the ranges covered. Note that values above 98 percent are not shown.

Dissolved Oxygen - As expected, oxygen content at Stations 1, 2, and 4 (Figures 10.a.-10.c.) reached maximum values (greater than 12 mg/1) during the colder months and minimums (2 to 4 mg/1) during the dry, hot season when saturation values decreased. A sharp drop in DO in July at Station 1 and in February at Station 4 suggests a slug waste load. An examination of the DO data shows that results for all four stations were similar during the January through April period and separated into a grouping of Stations 1, 2, and 3 versus Station 4 during the remainder of the year. It will be remembered that a poultry processing plant located approximately 15 miles upstream from Station 4 discharges untreated waste. This together with the fact that Pelahatchie Creek was observed to be extremely sluggish for long periods accounts for low DO results reported at Station 4.

Values less than the 4.0 mg/1 DO concentration which many health regulatory agencies recommend as a limit, were reported on numerous occasions at Pelahatchie Creek. Values approaching 4.0 mg/1

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FIGURE 9A
ANNUAL TURBIDITY VARIATION
STATION I

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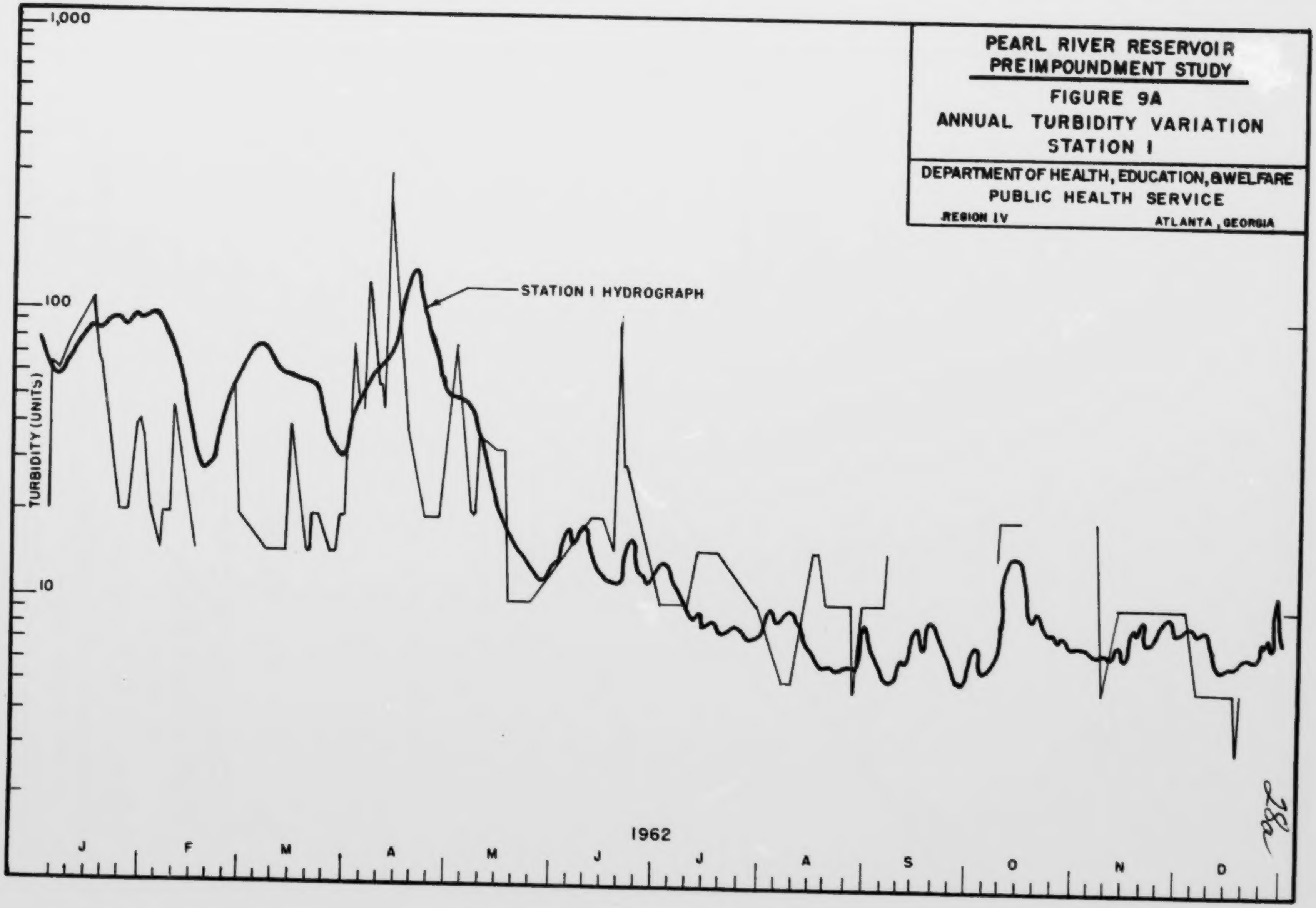

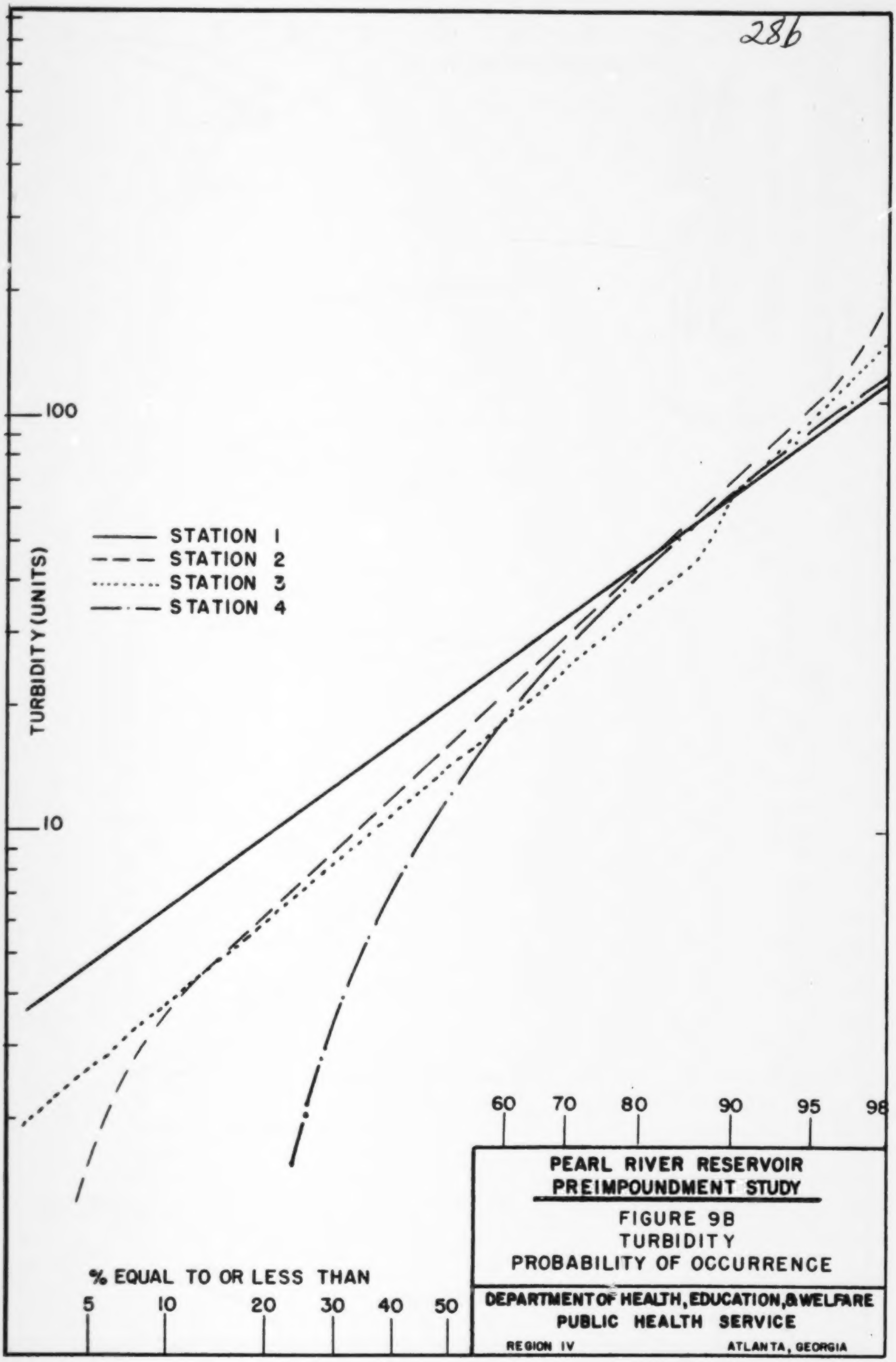

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FIGURE 9B
TURBIDITY
PROBABILITY OF OCCURRENCE

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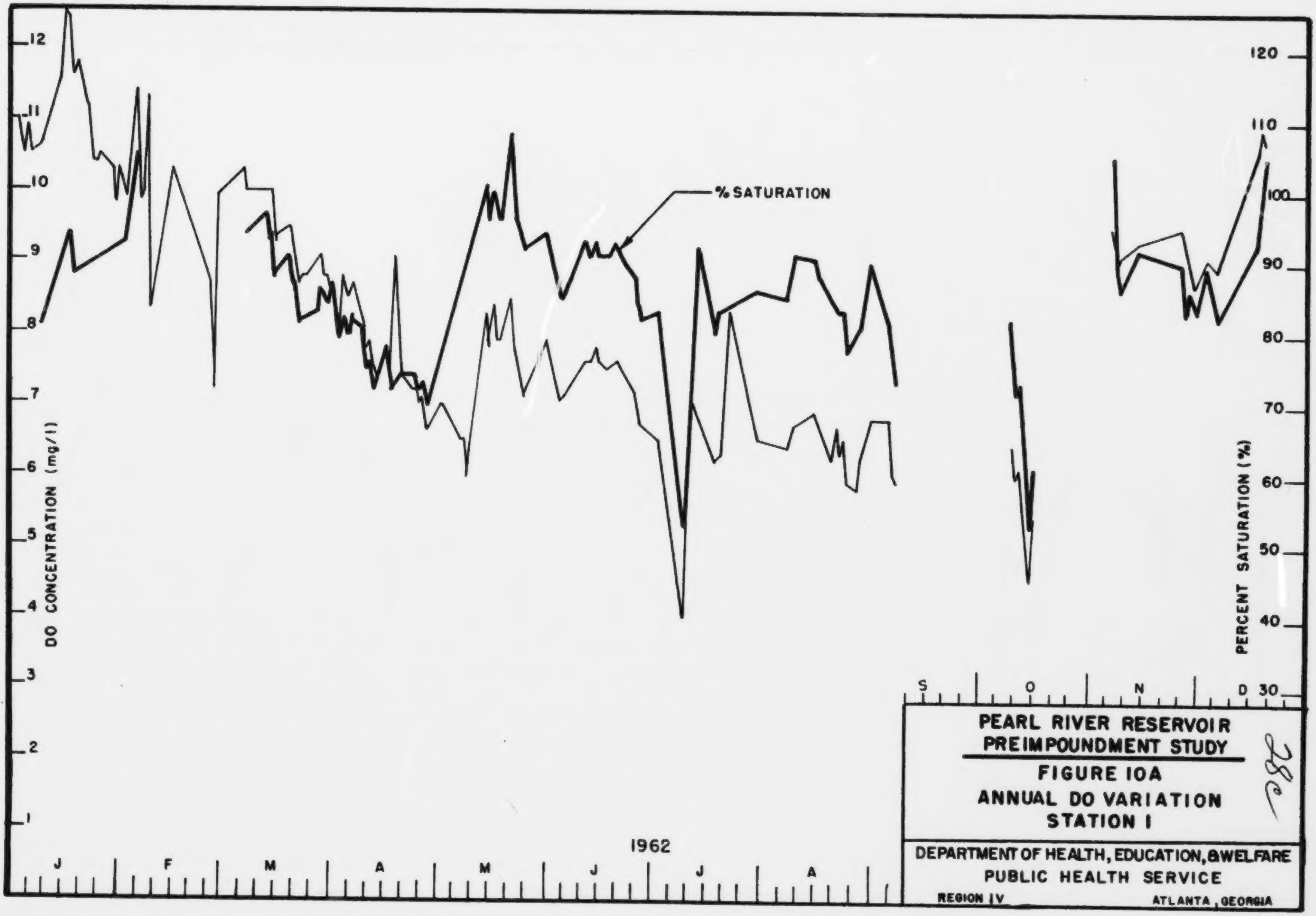

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FIGURE 10A
ANNUAL DO VARIATION
STATION I

28c

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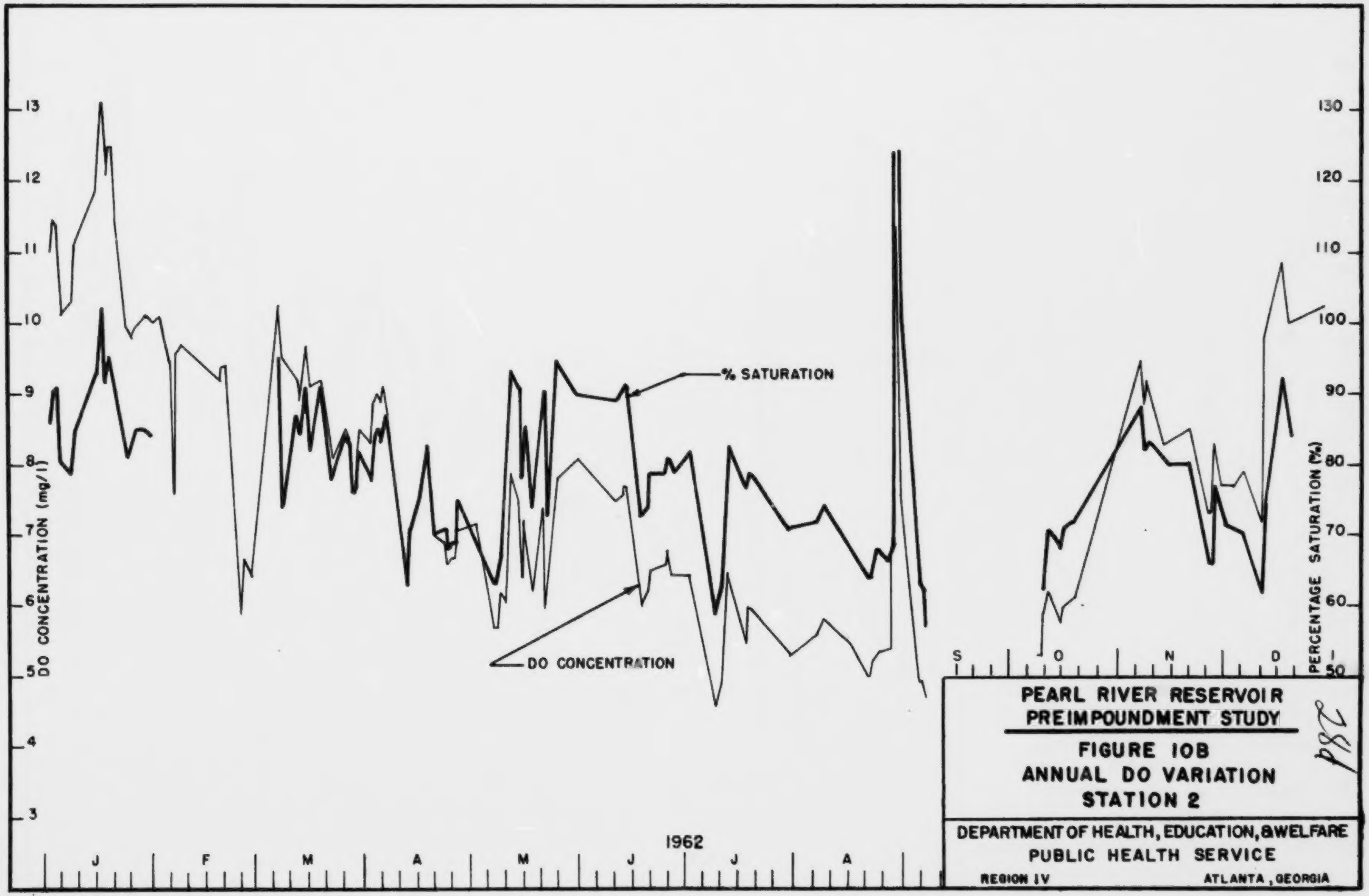

PEARL RIVER RESERVOIR
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28d

FIGURE 10B
ANNUAL DO VARIATION
STATION 2

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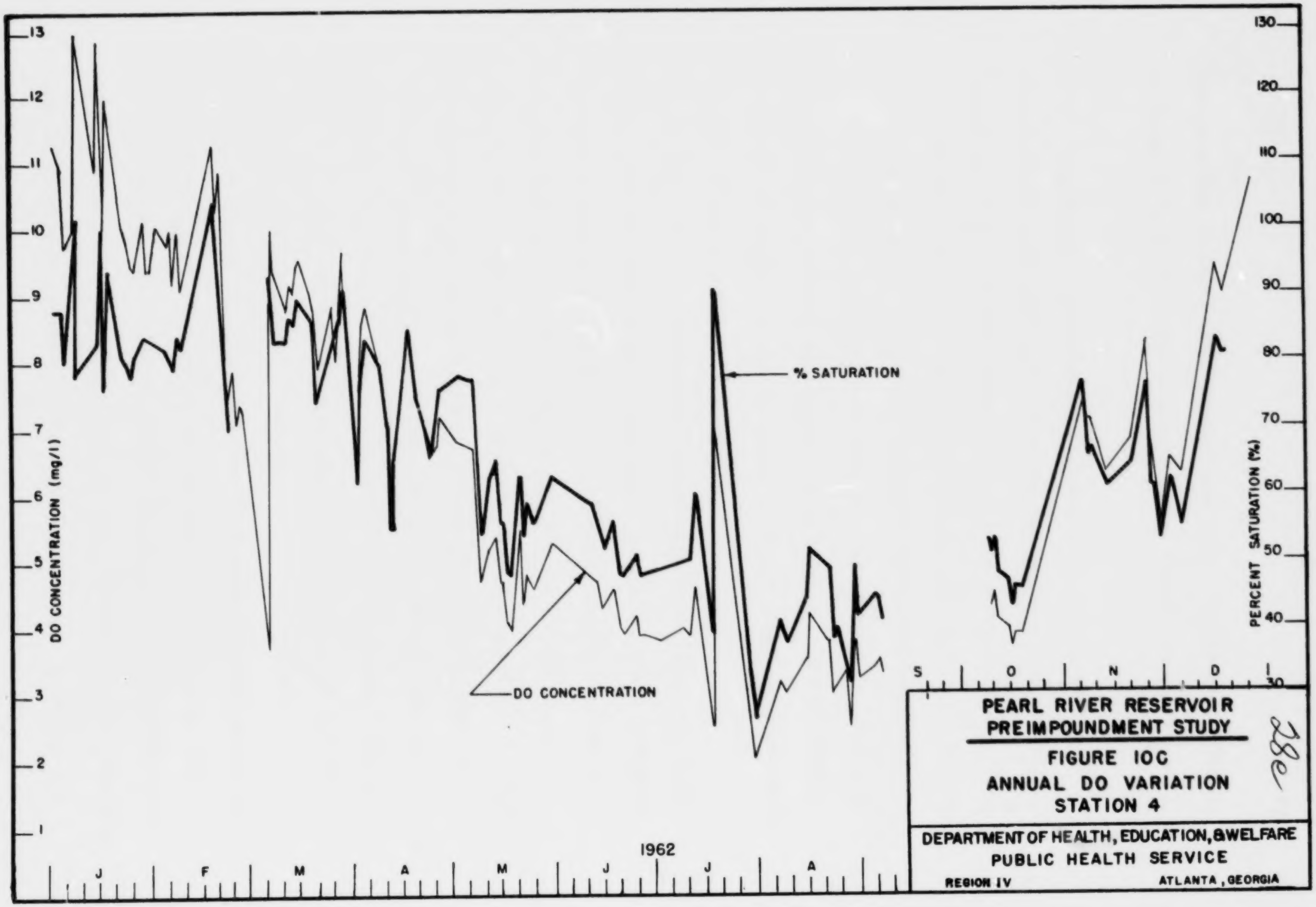

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FIGURE 10C
ANNUAL DO VARIATION
STATION 4

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were recorded at other sampling stations also. Detrimental effects on stream life which might be caused by low oxygen concentrations were not detected.

Alkalinity - Alkalinities reported at the first three stations were comparable and within the low range of 9 to 34 mg/l. Values for Station 4 were generally two to seven times higher, i.e., 33 to 85 ppm. In a later section it will be seen that total hardness content at Station 4 was usually less than alkalinity reported.

Alkalinity determinations were not made during the entire year. Because of this, supplemental data will be collected during the first six months of 1963 in order to obtain a more representative picture of annual alkalinity variation.

BOD - Five-day biochemical oxygen demand analyses were made three times per week whenever possible. Results obtained indicated that BOD's fluctuated between 0.1 and 4.0 mg/l but were normally reported between 1.0 and 2.5 mg/l. The effects on BOD of waste sources above Stations 2 and 3 appeared to be insignificant inasmuch as results at the dam were closely comparable. At Station 4 the depressed oxygen levels indicated higher upstream BOD, but the average value for this station was comparable to the other three. Average values of 5-day BOD for the year were 1.6, 1.6, 1.4, and 1.6 mg/l at the respective sampling stations.

An attempt to relate BOD results to variations in streamflow patterns (at Stations 1 and 2) is depicted in Figures 11.a. and 11.b. Continuation of December 1961 floods into January definitely appeared to have a diluting effect on BOD. However, stream discharge, during peaking or relatively constant flow periods, showed little

29a

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FIGURE 11A
ANNUAL BOD VARIATION
STATION 1

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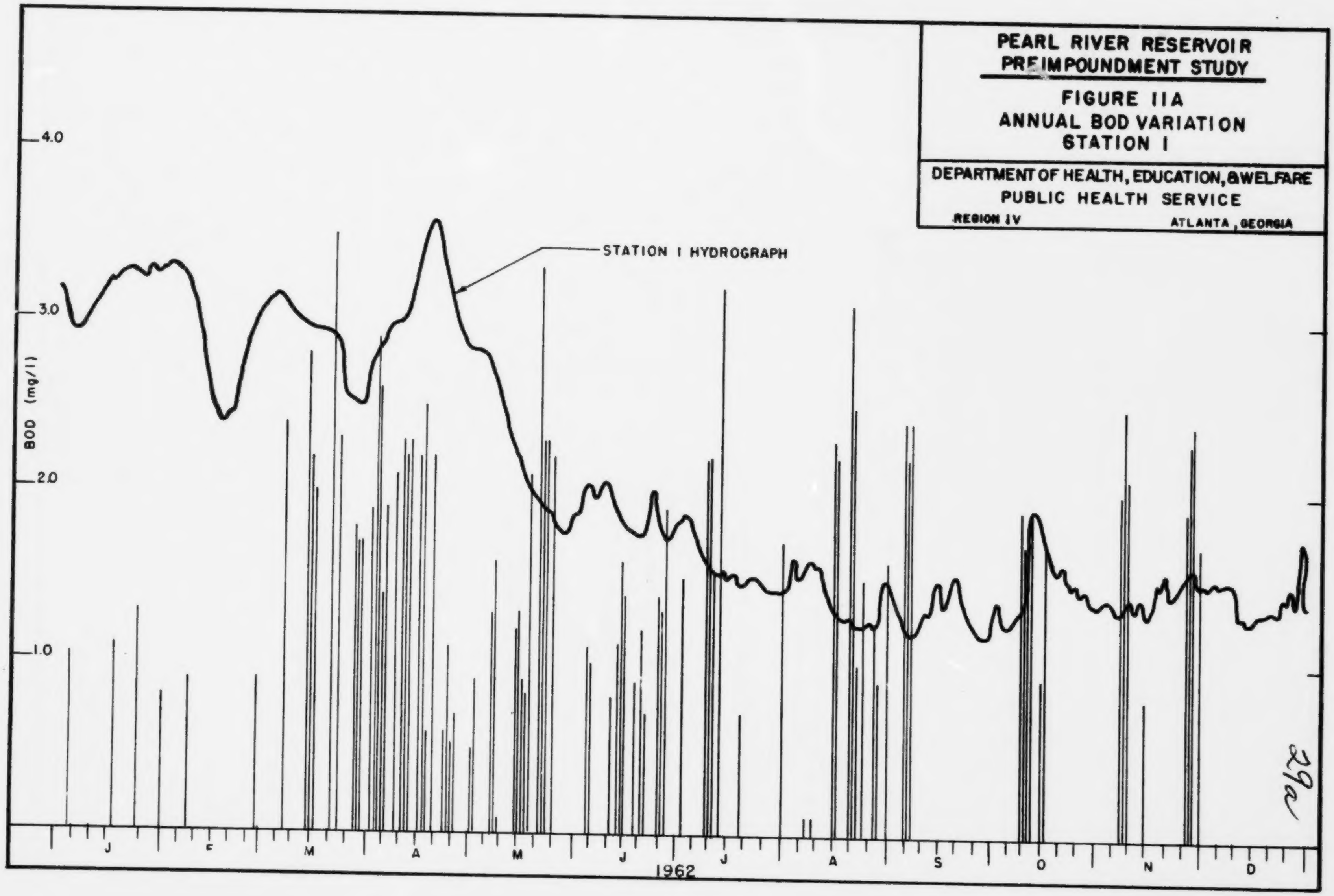

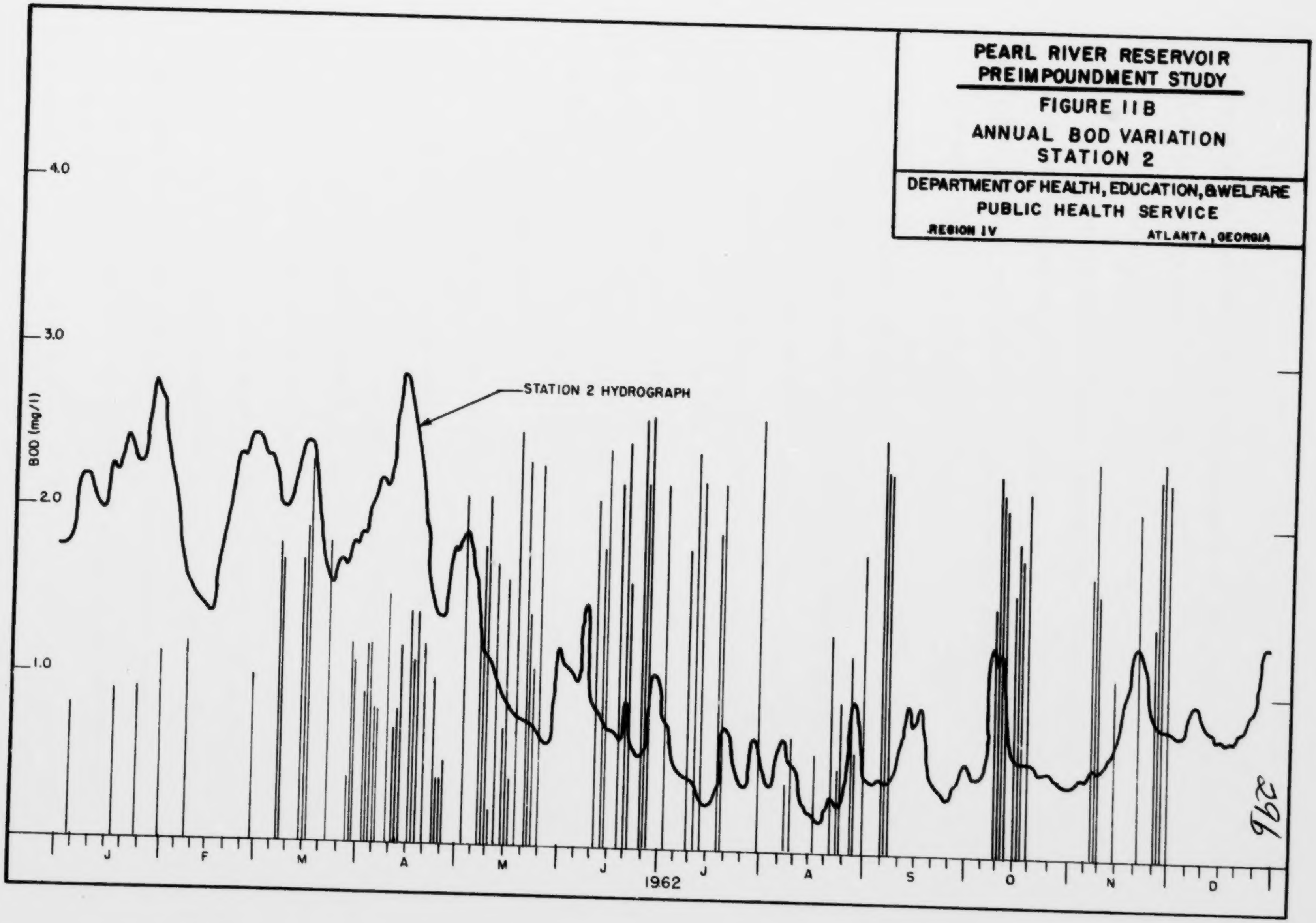

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FIGURE 11B

ANNUAL BOD VARIATION
STATION 2

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correlation with BOD during the remainder of the year. Diurnal changes are pertinent, and these will be discussed in the section on 24-hour studies.

During the period January through June 1963, ultimate first stage BOD studies will be made in order to determine k_1 factors. Reaeration rate (K_2) factors will also be the subject of future studies.

ANALYTICAL RESULTS - WEEKLY

General - Included in the schedule of weekly analyses were determinations for the important chemical and sanitary quality characteristics of residue, iron, manganese, coliform, and fecal streptococci. Grab samples were examined one or more times per week for residue (total, filtrable, fixed and nonfiltrable) and bacteriological elements. A composite sample comprised of 250 ml/sample day portions was analyzed to determine the concentrations of iron (Fe) and manganese (Mn) present. Annual variations for all these constituents are discussed below.

Residue - Total residue content for all four stations as depicted in Figure 12 shows a family of generally similar curves. Annual variations were pronounced, and values ranged from less than 70 mg/l to more than 300 mg/l. Four major peaking periods occurred: in April, early June, early August, and September. While the increase in total residue occurring in April may well be related to increased runoff, the three succeeding peaks show no correlation with stream discharge. It is possible that the June, August, and

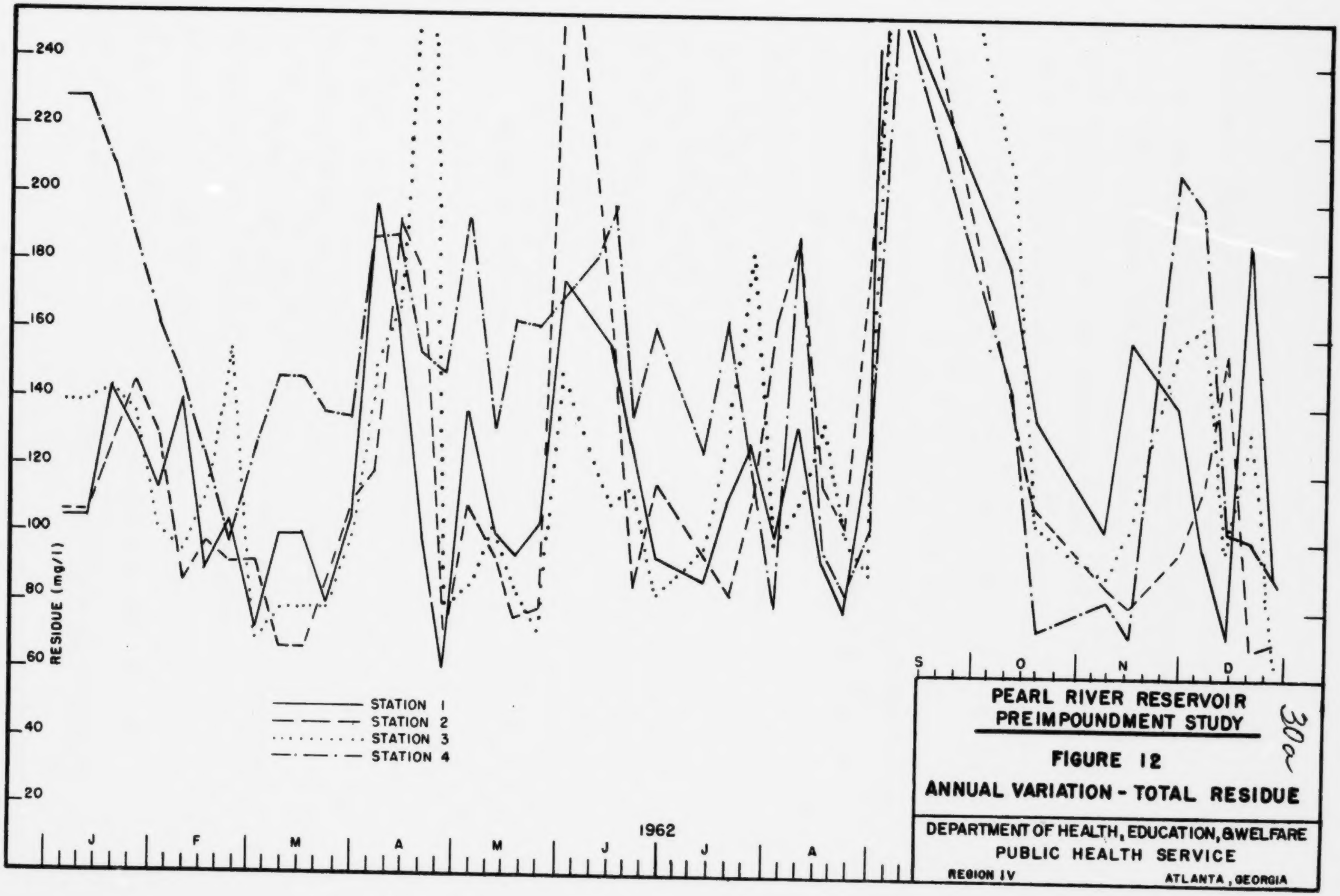

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FIGURE 12

ANNUAL VARIATION - TOTAL RESIDUE

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September increases are attributable to higher total plankton counts associated with the summer and early fall seasons.

Fixed residue concentrations indicate that April peaks were due to runoff and the remaining three peaks to increases in volatile solids (plankton). The inorganic, fixed solids formed a proportionately higher amount of the total in April than in June, August, or September.

Data concerning amounts of filtrable and nonfiltrable residue were collected only during the latter part of 1962. Analyses will continue through June 1963 in order to establish valid relationships between the two types of solids and also with other variables. Results obtained thus far, however, show nonfiltrable to filtrable residue ratios varying between 0.3 and 44 for Stations 1-3 and between 3 and 70 at Pelahatchie Creek. Highest ratios were reported during low flow periods in November and December when reproduction rates of flora and fauna in streams decreased.

During the year, average total residues at Stations 1, 2, 3, and 4 were 120, 119, 126, and 129 mg/1 respectively. These values may be compared to average fixed residue amounts of 83, 78, 83, and 102 mg/1. Unusually enough, the ratio of average total residue to fixed residue was approximately 1.5 on all streams.

Bacteriological - The results of weekly grab sample analyses for presence of coliform and fecal streptococci organisms are inconclusive, although definite trends are indicated. As will be discussed in a later section, 24-hour studies show that diurnal variations are quite pronounced. These "round-the-clock" studies are more reliable indicators of bacteriological water quality and will be utilized in continuing studies for interpretation purposes more than weekly analyses.

A graphical representation of some of the weekly counts at Stations 1-3 are shown in Figure 13.a. and 13.b. Bacteriological values ranged during the year from less than 200 coliform MPN/100 ml at Station 1 to greater than 20,000 MPN/100 ml at Station 3. Fecal streptococci counts were as high as 1000/100 ml at Station 2 and as low as zero at all stations.

Examination of most probable number (MPN) and membrane filter (MF) coliform results for Station 1 (Figure 13.a.) indicates some correlation between the results for these two procedures. This was true at other sampling points also. The MF results for coliform were generally less than the MPN's but on occasion were several hundred higher in the ranges detected. Additional study is needed for a more valid interpretation to be made.

Maximum counts for both bacteria types occurred in June and July when coliform MPN per 100 ml approached or exceeded 10,000. High flows at the beginning of the year had a moderating effect on coliform MPN at Stations 1 and 2. A seasonal decline for most bacterial counts followed the June and July peaking period. At Station 3, this decline might be explained by the initiation of stabilization pond waste treatment at nearby Carthage, Mississippi. While the bacterial population decline at other sampling points might be dependent on an accelerated die-off rate, further studies must be made to substantiate this.

32a

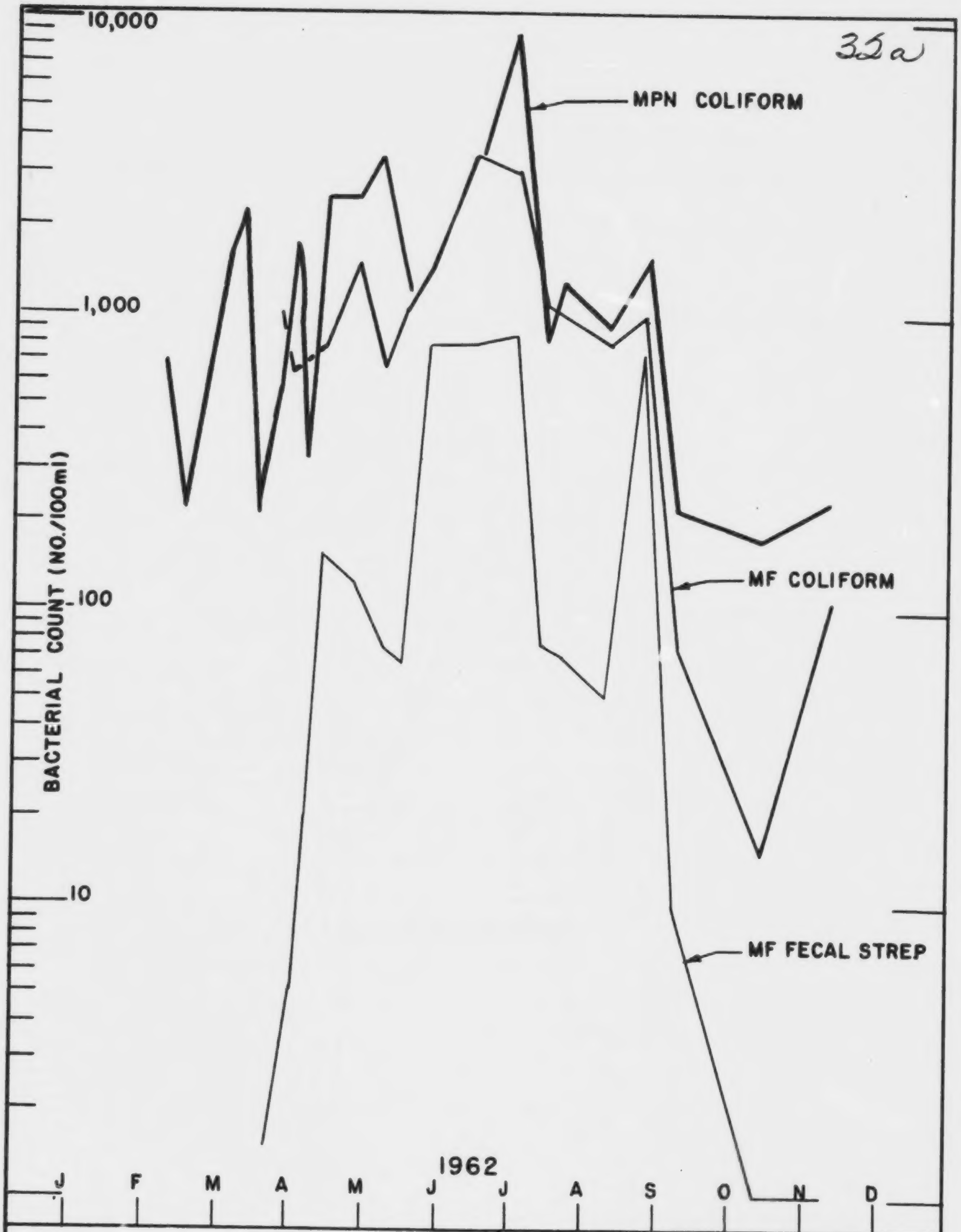

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FIGURE 13A
ANNUAL BACTERIOLOGICAL VARIATION
STATION 1

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32b

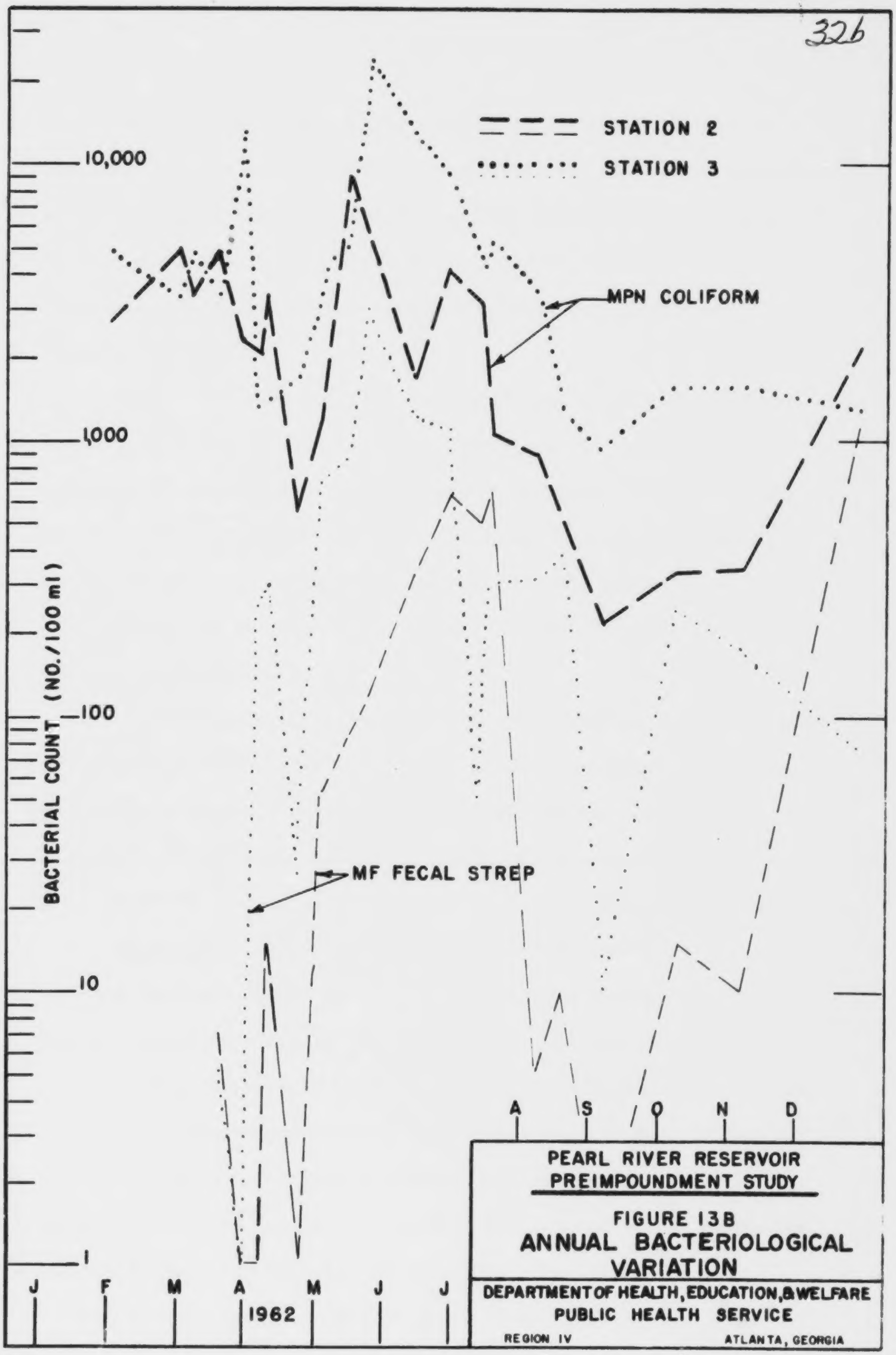

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FIGURE 13B
ANNUAL BACTERIOLOGICAL VARIATION

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As would be expected, the average coliform MPN at Station 1, computed from the limited results available, was the lowest reported among the four. Averages ranged from 1600 per 100 ml at the dam to 5000 per 100 ml at the upper Pearl River Station. An effort is being made to establish more firmly the bacteriological water quality at all sites.

Iron - Analyses for iron were performed on weekly composite samples preserved by acidification. Although the results were validated by comparison with grab sample analysis, interpretations should be made with some caution. The range of values obtained during the year are shown in Figure 14. Results varied from 0.00 to 0.94 mg/l and averaged 0.26, 0.29, 0.26, and 0.19 mg/l at the respective stations.

Concentrations exceeding the 0.3 mg/l Drinking Water Standards limitations were found on numerous occasions, particularly during the months of January through June. Lowest values occurred at Station 4, while weekly maximums occurred alternately at Stations 1-3. Widely varying results were reported in October and November.

Manganese - Concentration of this element was consistently reported less than 0.020 mg/l at all sampling stations. Only nine weekly composites, distributed evenly among the four reporting stations, were discovered to have manganese concentrations exceeding 0.020 mg/l. These composite analyses were for the weeks of August 12 and October 7. The highest value reported was 0.175 mg/l on the upper Pearl River. As in the case of iron, no particular tributary was responsible for high manganese values. Further studies are being performed to determine the cause of the manganese peaking.

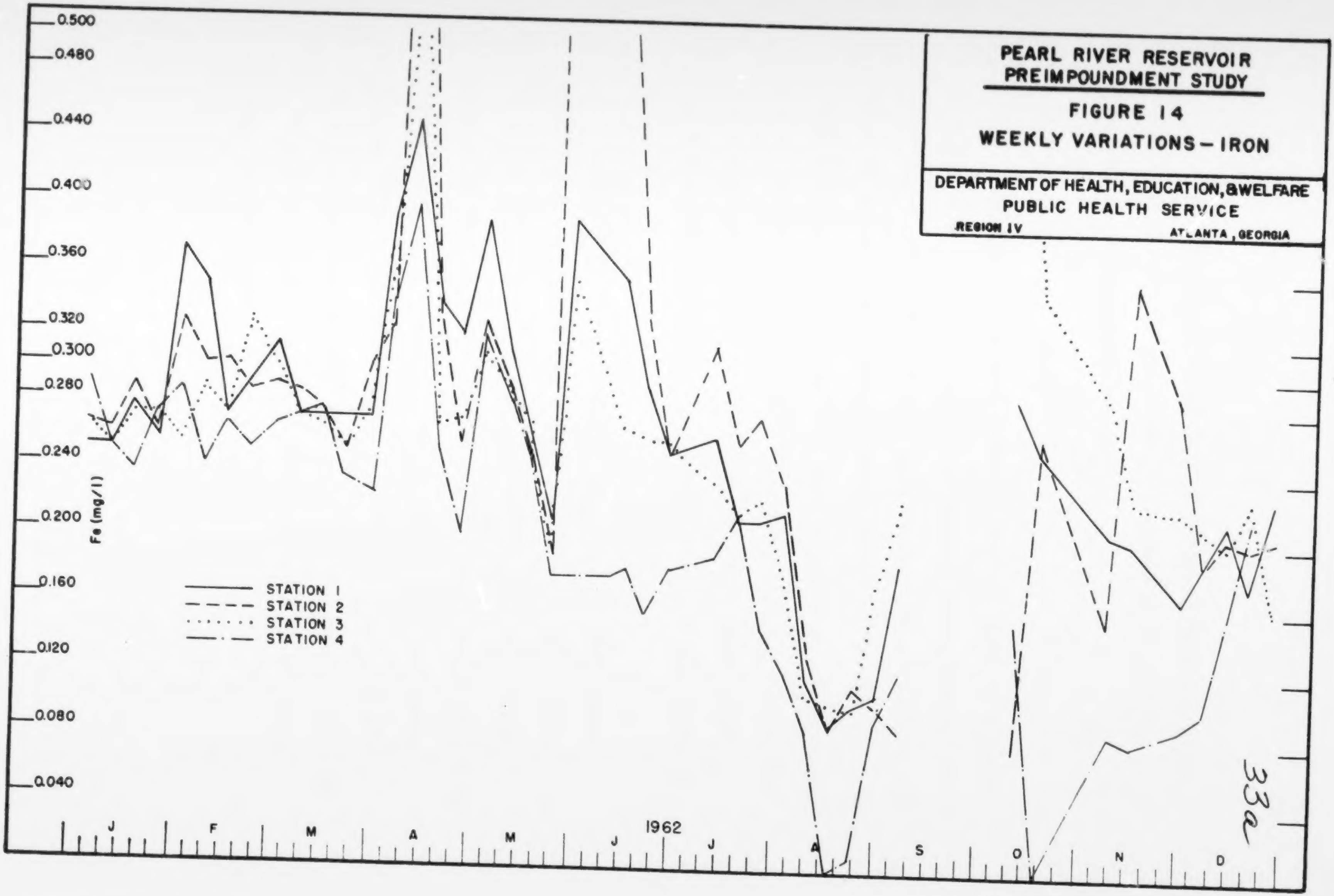

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FIGURE 14
WEEKLY VARIATIONS – IRON

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The 1962 Public Health Service Drinking Water Standards limit of 0.05 mg/l for manganese in finished water was exceeded only on the above-mentioned dates.

ANALYTICAL RESULTS - MONTHLY

General - The monthly analysis schedule shown in Figure 4 includes some of the more important chemical water quality characteristics. Grab samples were examined for such constituents as chemical oxygen demand (COD), phenol, radioactivity, and surfactant. Composites were analyzed for the other items shown. Concerning phenol, radioactivity, and lead (Pb) determinations, the project laboratory reported little or no variation for these elements. Their reported values will be discussed in appropriate sections below.

COD - When stream discharge was highest from February to May, COD values were lowest. Minimums attained ranged from 7.0 to 12.5 mg/l at Stations 1-3 and dropped to 15.5 mg/l at Station 4. Conversely, maximum COD concentrations between 18.0 and 25.0 mg/l occurred during the drought when dilution factors were lowest. Although dilution appears to affect COD values, the data also indicate a substantial load from surface runoff and/or that lower temperatures and shorter flow times in the winter resulted in higher concentrations.

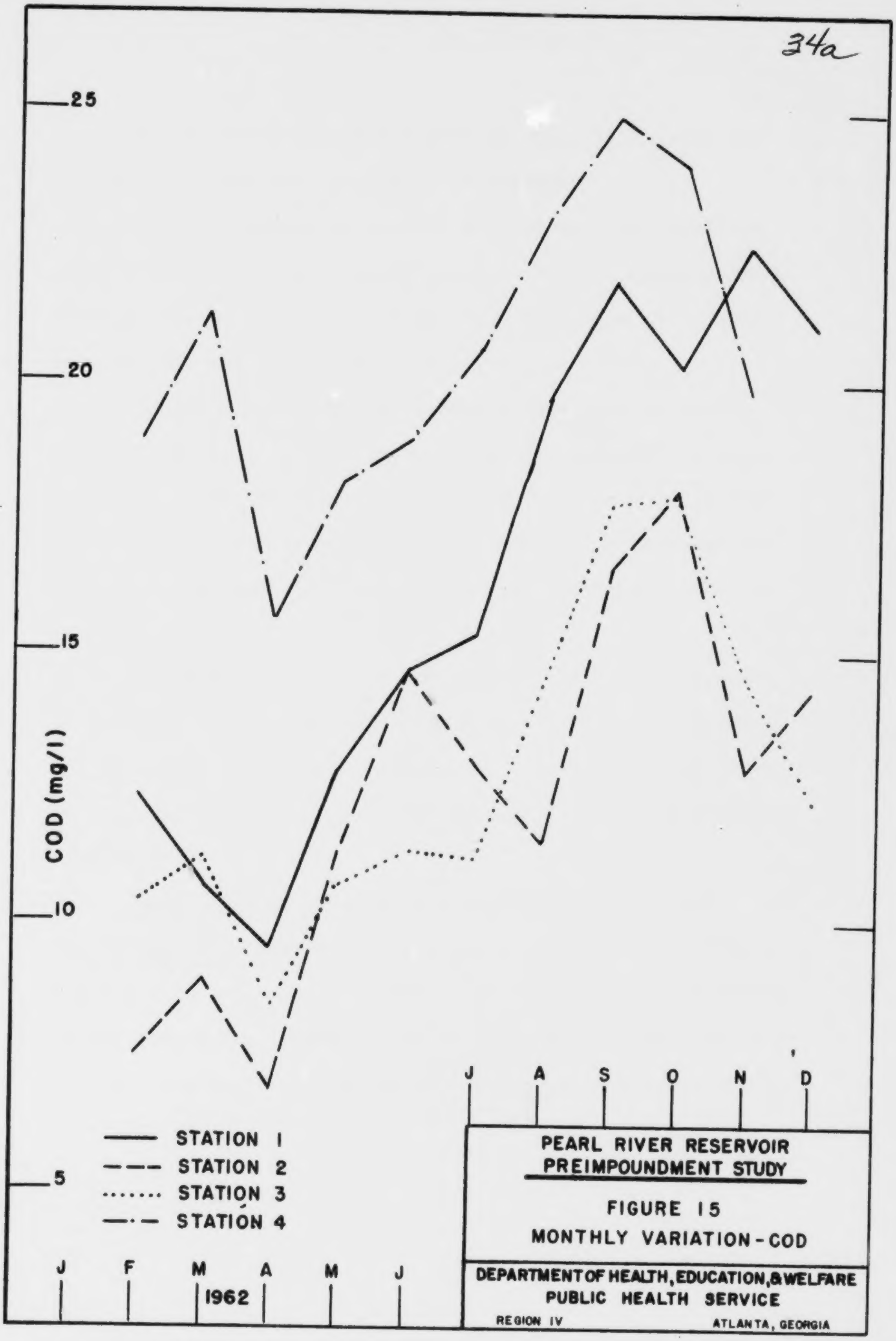

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FIGURE 15
MONTHLY VARIATION - COD

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Average chemical oxygen demand was 15.1, 11.3, 11.7, and 18.1 mg/l for Stations 1 through 4 respectively.

Phenol - Analyses of samples from all stations failed to produce detectable quantities of phenol. Phenolic compounds which allegedly caused a fish kill in the Pearl River near Philadelphia were not detected at Station 3.

Sulfate - Figure 16 depicts annual variations in sulfate analysis results. The four curves shown are comparable in shape and amounts. In the period March through July, peak values from 17 to almost 30 mg/l were reported. Floodwaters in December 1961 and January and March of the study year had a diluting effect on sulfate content.

Averages at Station 1-3 varied from 11.3 to 13.5 mg/l and at Station 4 the average was almost 18 mg/l. All values reported are considered to be low concentrations. They ranged from 10 to 50 times less than the recommended 250 mg/l limit in the Drinking Water Standards.

Total Hardness, Calcium, and Magnesium - Total hardness and its calcium and magnesium salt components varied only slightly at Stations 1-3. As shown in Figure 17 and 18, values ranged between 10 and 24 mg/l for hardness, 3 to 17 for magnesium, and 3 to 15 for calcium. Hardness averaged approximately 18 mg/l at these first three stations.

35a

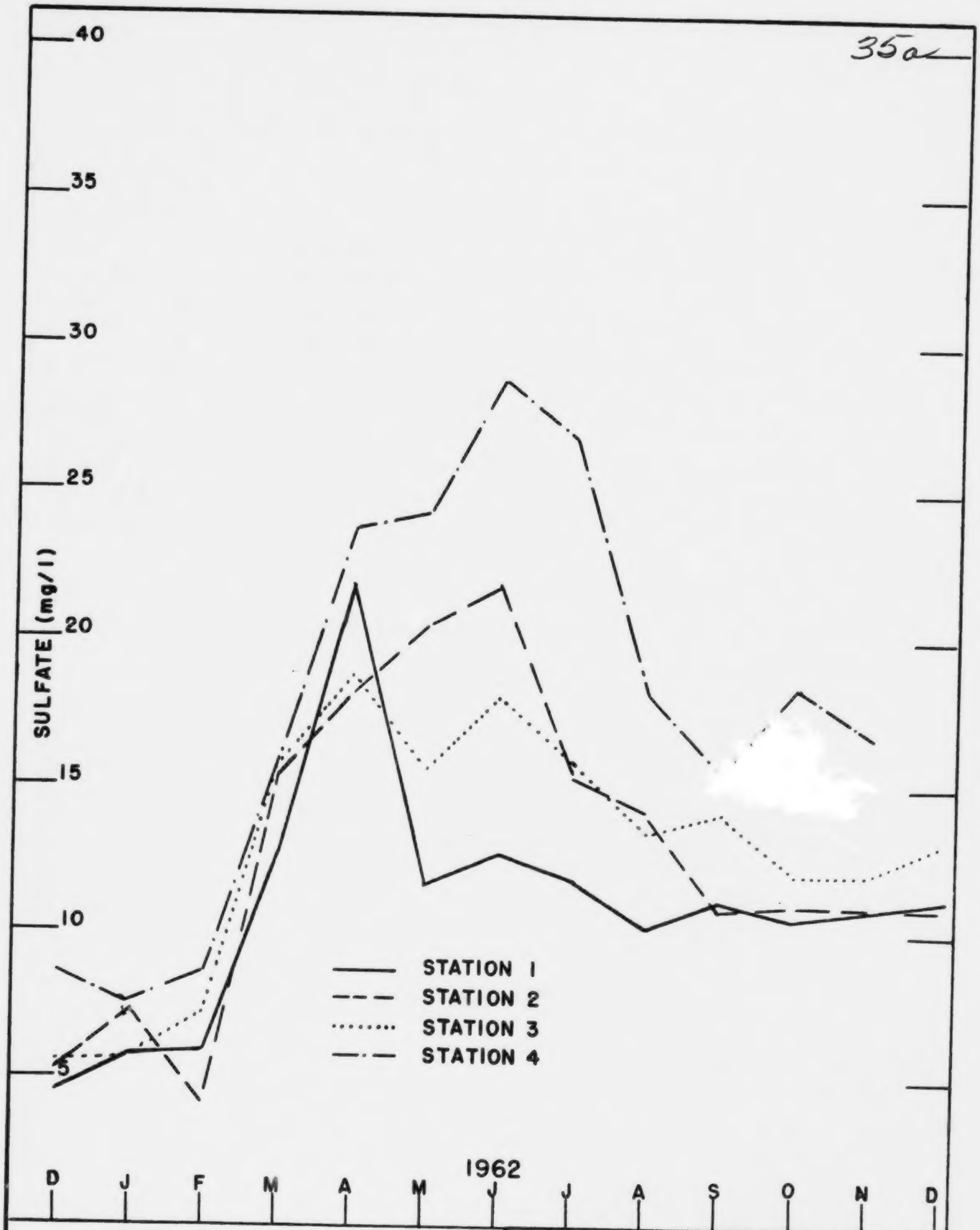

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FIGURE 16
MONTHLY VARIATION - SULFATE

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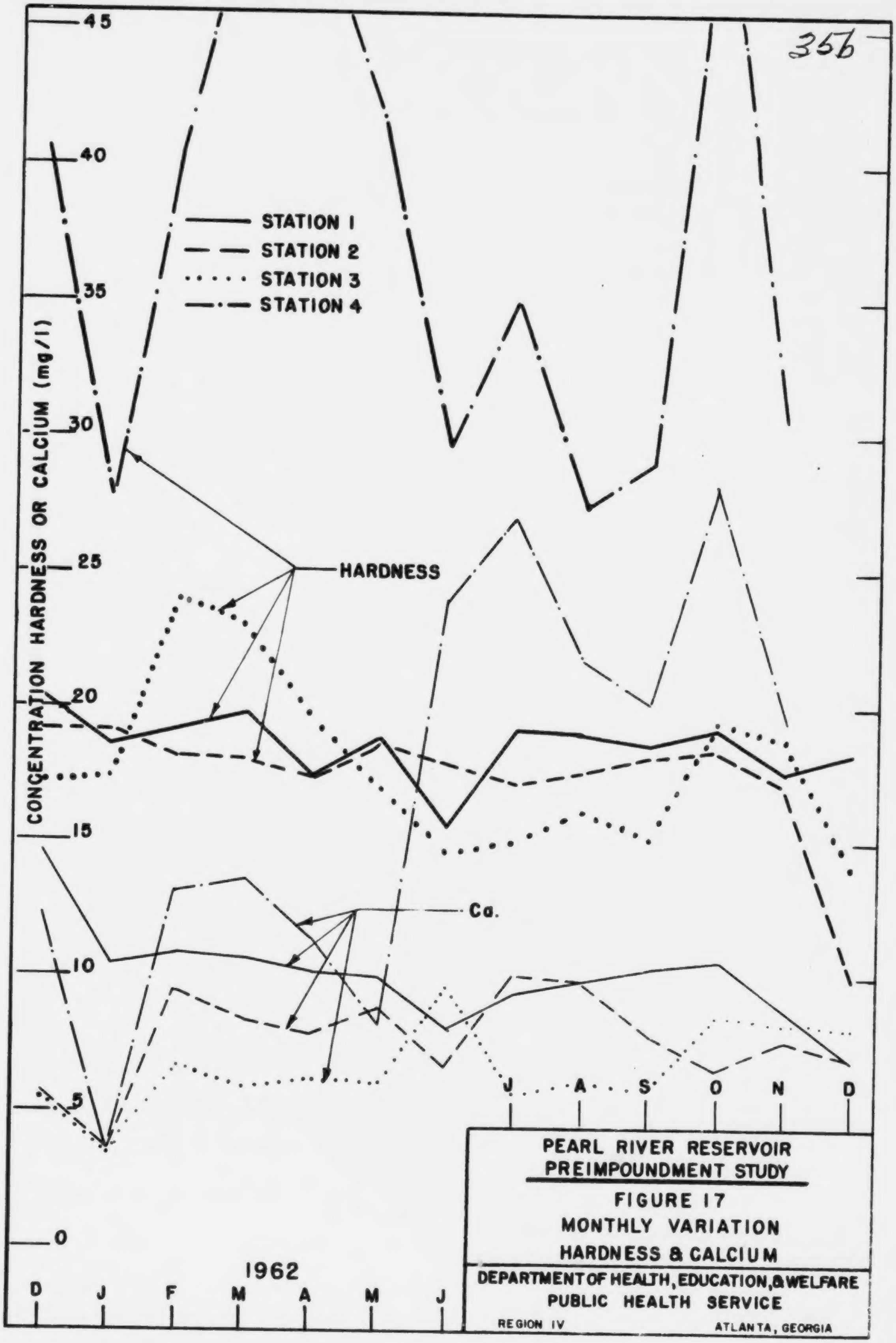

PEARL RIVER RESERVOIR
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FIGURE 17
MONTHLY VARIATION
HARDNESS & CALCIUM

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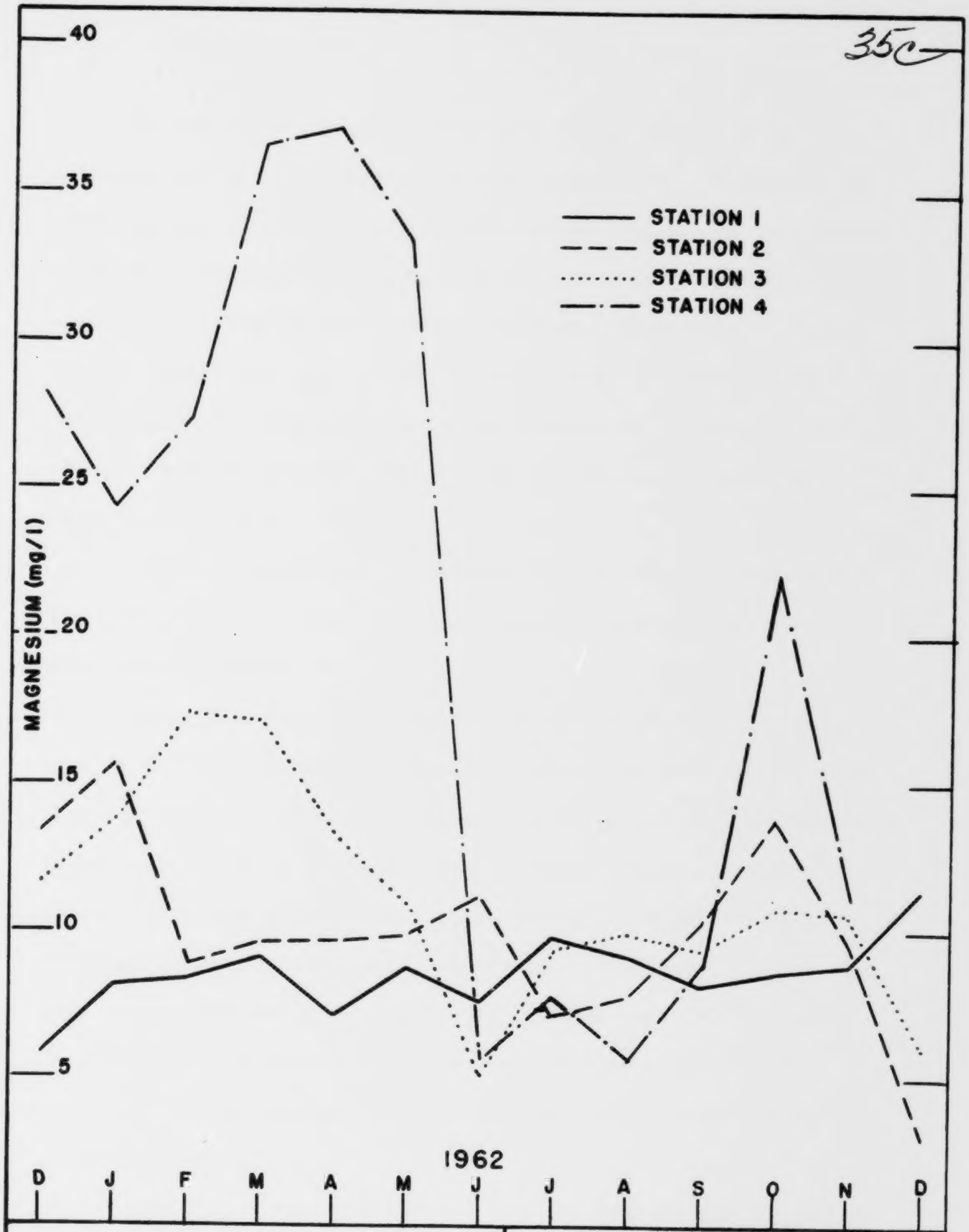

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FIGURE 18
MONTHLY VARIATION – MAGNESIUM

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At Station 4, concentrations were higher (up to 50 mg/l hardness) and monthly fluctuations more pronounced. Of course, the water quality at this station is affected more by stream environment than other stations. During periods of high runoff, magnesium salts accounted for most of the hardness reported. Conversely, calcium content constituted most of the hardness in the low-flow season. Ground-water fed base flow during the drought had a proportionately higher amount of calcium. The average hardness at Pelahatchie Creek was 35.5 mg/l.

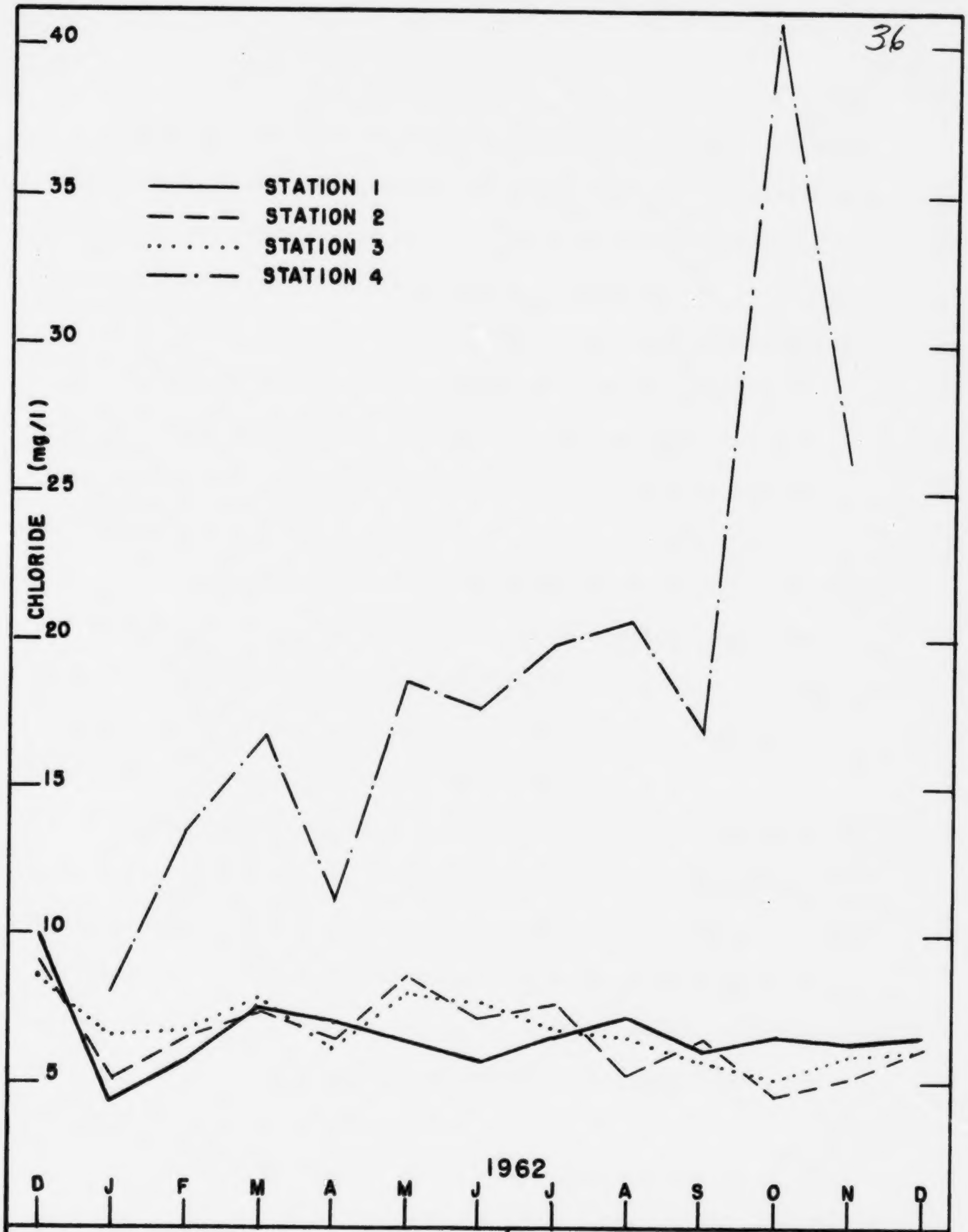
Hardness content in all streams sampled was considered quite low. This is not unusual in the southeastern United States where soft water is common.

Chloride - Figure 19 exhibits the almost identical results (4.0 to 8.5 mg/l) of monthly chloride analyses on the larger streams. Chloride concentrations in Pelahatchie Creek waters were substantially higher than at other stations - 8 to 40 mg/l. This is probably due to salt from year-round poultry slaughtering plant waste releases. Since chlorides are considered conservative pollutants, meaning that they are not subject to biological or chemical degradation, values at Station 4 were highest when the dilution factor was lowest.

All concentrations reported were well within Drinking Water Standards limitations.

Lead (Pb) - All lead analysis results from monthly composites were reported less than 0.02 mg/l; less than the 0.05 mg/l Drinking Water Standards requirements.

Radioactivity - Only normal background counts were recorded during radiological examinations.



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 19
MONTHLY VARIATION-CHLORIDE

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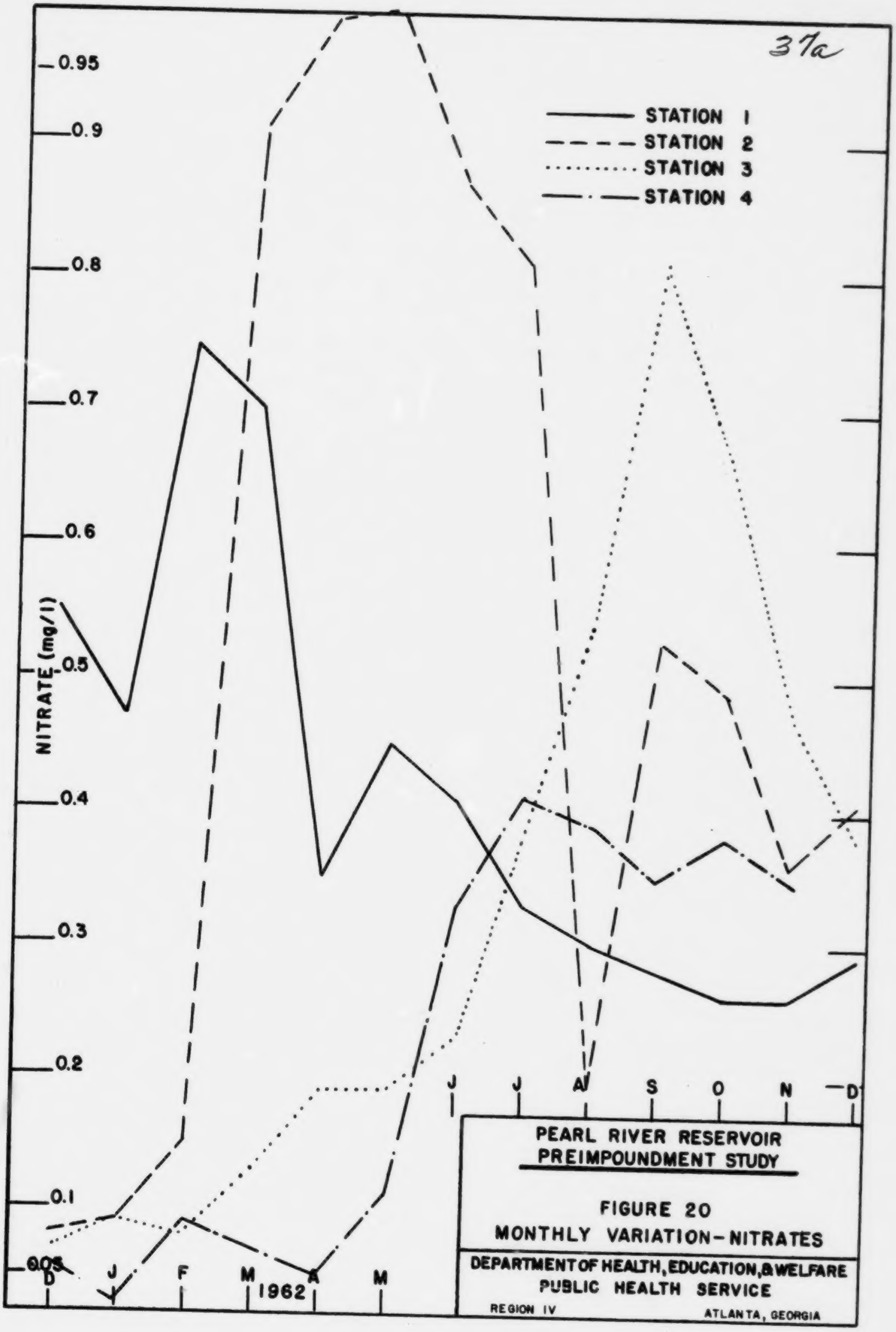
Nitrate - This important water quality characteristic, which frequently indicates the presence of sewage pollution, varied widely throughout the year (Figure 20). In spite of precautions taken to maintain samples in an unaltered state, results for nitrate analyses are questionable. Because there is reasonable doubt concerning the results, special nitrogen cycle studies will be performed on all streams during 1963. These studies will include examinations for ammonia, nitrate, and total organic nitrogen as well as nitrate-nitrogen.

Definite trends are indicated in Figure 20, however. Stations 2-4 values generally increased during the year while lower Pearl River nitrate data showed a gradual decline from 0.75 to 0.26 mg/l. Highest concentrations approaching 1.00 mg/l were reported on the Yockanookany River in the spring and summer.

Tannin-like Compounds - A definite cause and effect relationship can be illustrated by the analysis data shown in Figure 21. Monthly variations in tannin-like compounds were closely related for all reporting stations, and they followed peaks of mean monthly stream discharge (Figure 6.a.). In the drought period, concentrations were less than 1.0 mg/l and values exceeding 2.0 mg/l were evident during the January and April floods.

The background data on tannin-like compounds may prove important at a later date when effects of impoundment are ascertained; especially if color problems develop.

Silica - Like the tannin results, silica analysis data showed (Figure 22) a direct relation to stream discharge. Concentrations declined to lows in the 10 mg/l range in the fall and reached 30 to



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 20
MONTHLY VARIATION-NITRATES

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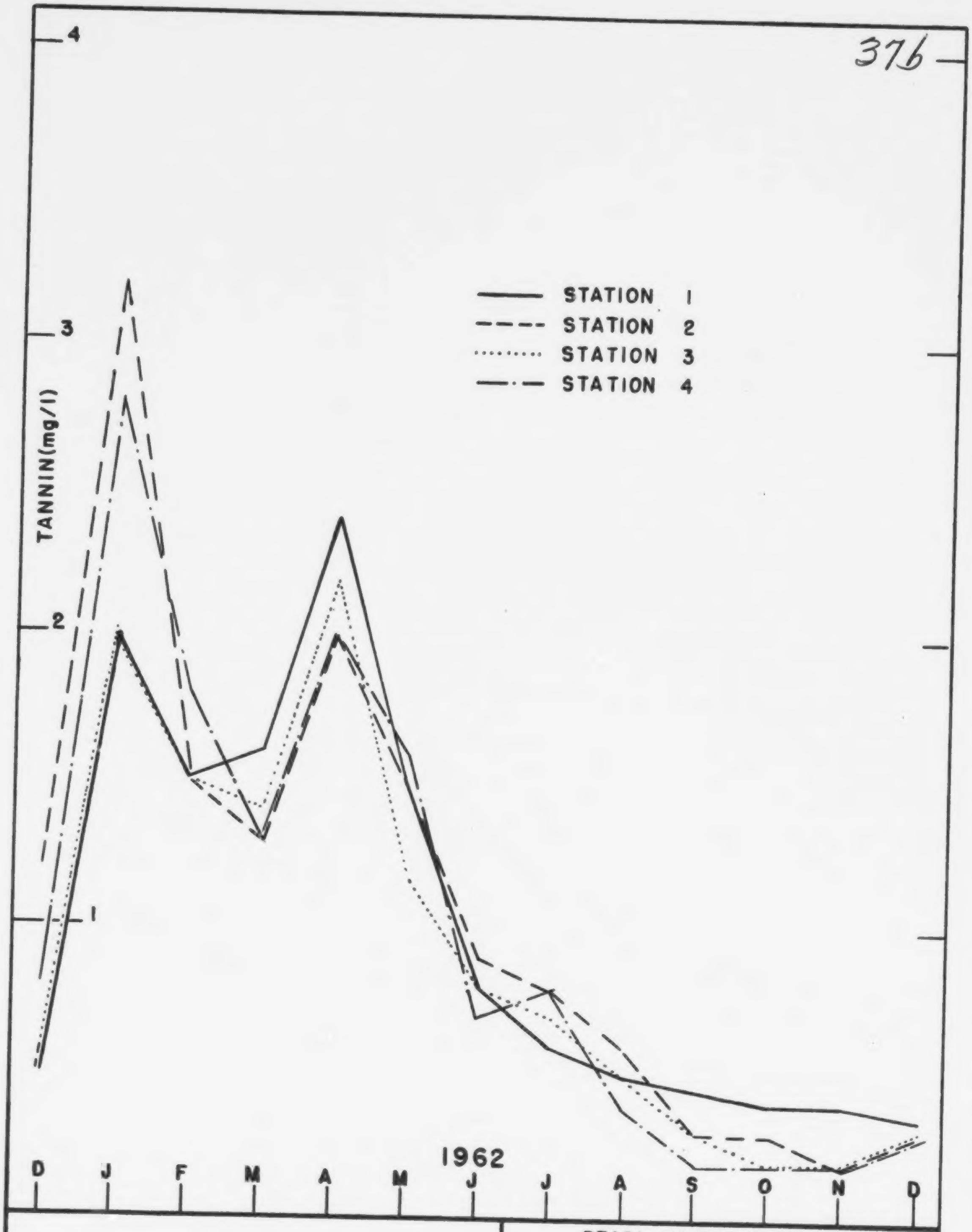

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FIGURE 21
MONTHLY VARIATION
TANNIN-LIKE COMPOUNDS

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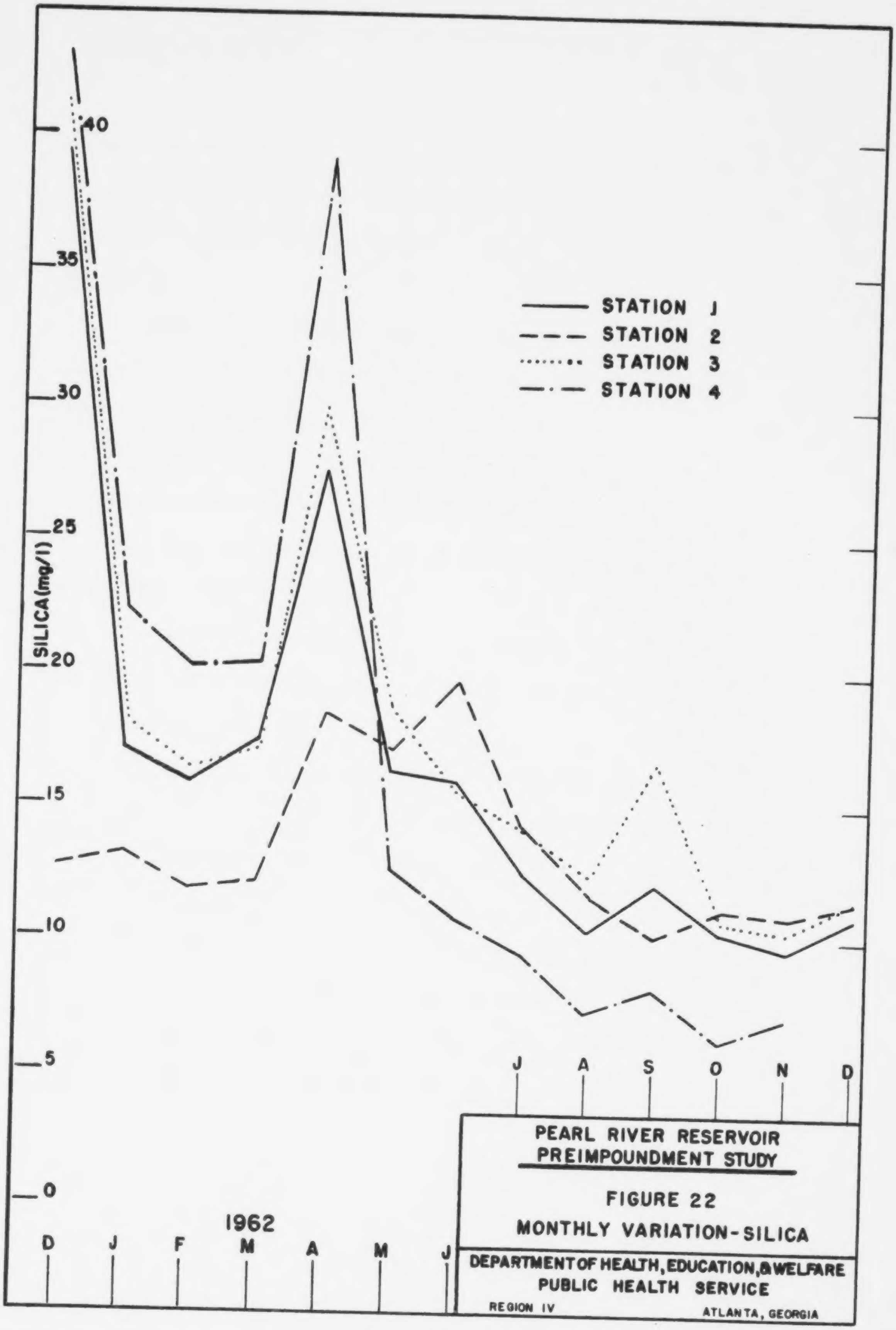

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 22
MONTHLY VARIATION-SILICA

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40 mg/l during the April storm runoff. For boiler-water makeup purposes the raw waters of the Pearl River would be suitable for 0-150 psi boiler feeds. Treatment would further reduce the silica content.

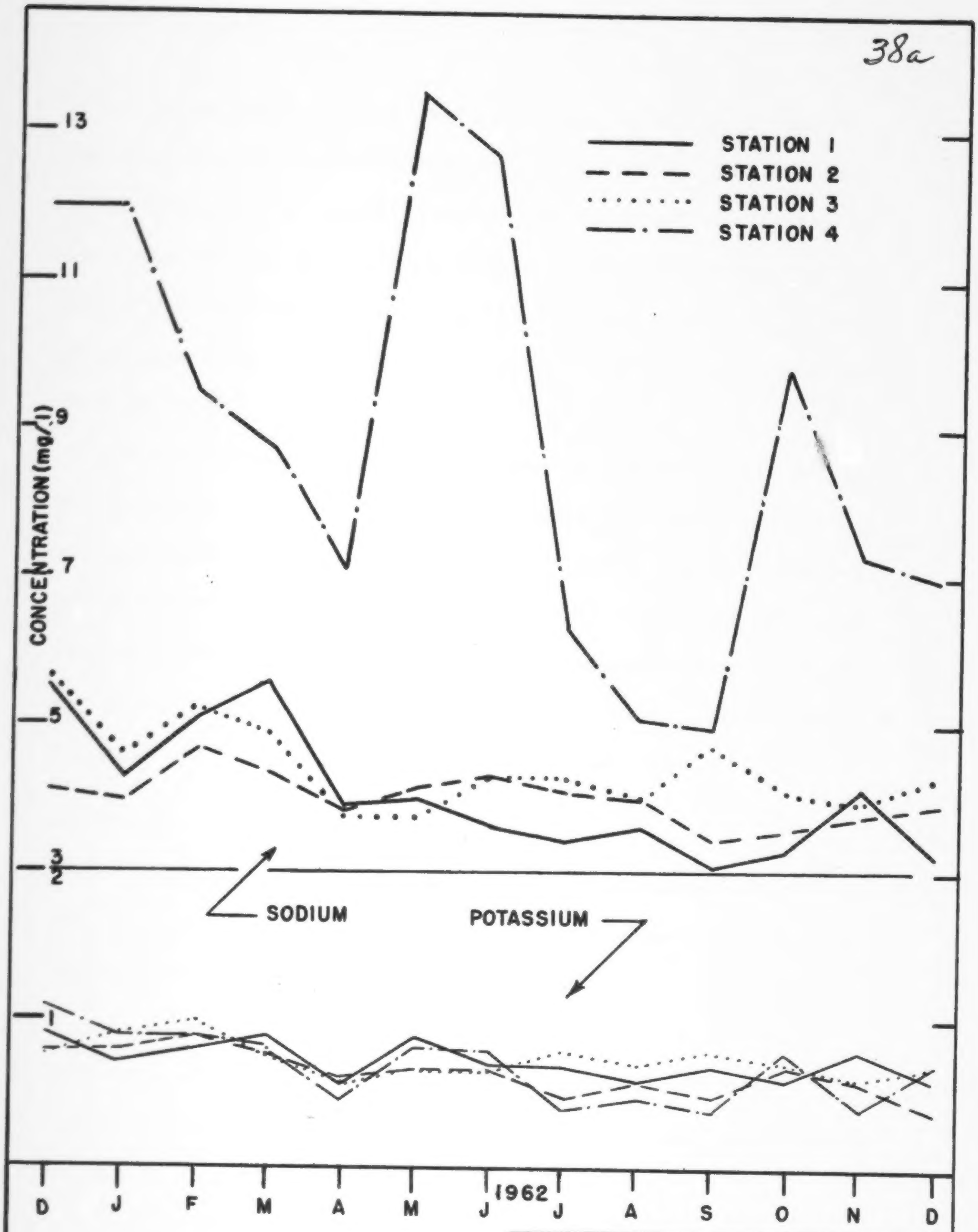
Sodium (Na) and Potassium (K) - These two water quality characteristics are reported together since they were usually determined concurrently. Figure 23 illustrates monthly variations.

Sodium values - again, higher at Station 4 - declined slightly during the year and ranged between three and six mg/l for Stations 1-3. Sodium amounts up to 13.5 parts were found in Pelahatchie Creek composites.

Potassium concentrations in all streams were practically identical. A gradual decline from 1.0 to 0.5 mg/l occurred during the study year.

Surfactant (ABS) - Laboratory analyses for presence of surfactants were initiated in July. These determinations will continue until a full year's data are obtained.

Similar values were reported at all stations. Surfactant concentrations were in the range of the minimum detectable limit by the methylene blue method. It would appear that the Drinking Water Standards recommended limit of 0.5 mg/l is well beyond the present range of surfactant content.



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 23

MONTHLY VARIATION-SODIUM & POTASSIUM

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Phosphates - Analyses were performed on composite samples for total phosphate, orthophosphate, and polyphosphate. Inasmuch as phosphorus is an essential element in the growth of plants, it was deemed necessary to obtain background data on the various compound forms. The future potential of the reservoir as a source of nutrients for algal development might be more reliably predicted from these data.

Peak values were reported in midyear for most stations. At the beginning and end of the year, minimums of total phosphate approaching 0.00 mg/l were attained. Station 1 results exhibited the highest concentrations - up to 0.24 mg/l orthophosphate - and Station 3 the lowest - <0.04 mg/l orthophosphate. Application of fertilizer at the beginning of the growing seasons probably accounts for peak values occurring in March, April, and May.

ANALYTICAL RESULTS - SEMIANNUAL

General - Composites for semiannual analyses were prepared from 10 ml per sample-day portions. Two such composites for each station were examined during the year for fluoride, selenium, arsenic, copper, and silica content. In addition, grab samples were analyzed routinely for presence of hexavalent chromium. Validity-of-data checks will be performed for all scheduled analyses subject to long periods of storage.

Fluoride - Only traces of fluoride were detected in samples analyzed. Values at all stations were comparable and ranged between 0.05 and 0.15 mg/l. Lowest concentrations (0.05 and 0.07) were found in Pelahatchie Creek waters, while Station 3 had the highest

(0.15 and 0.10 mg/l). Recommended limits in the Drinking Water Standards were not approached. The natural fluoride concentration is below optimum levels for prevention of tooth decay.

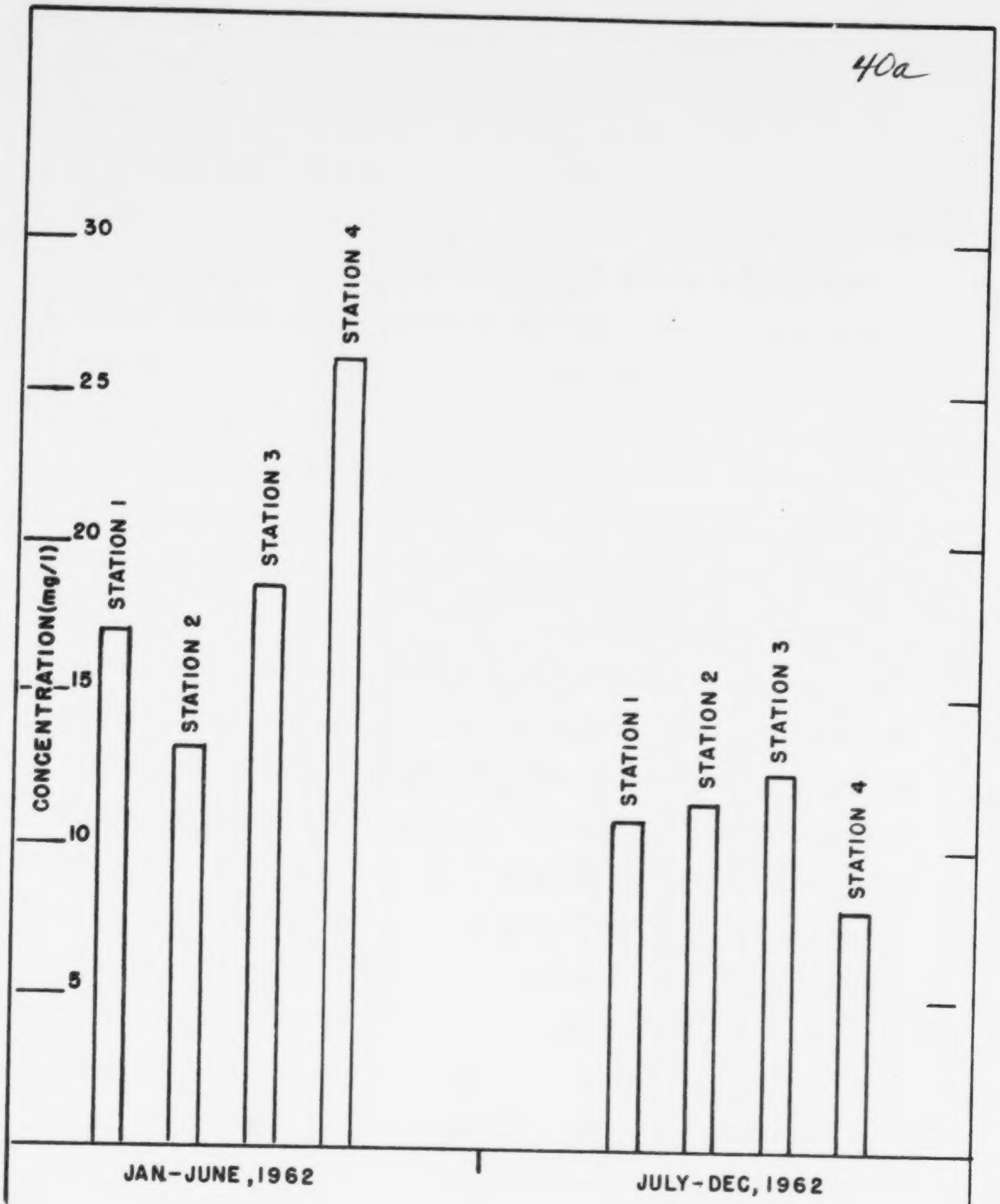
Selenium (Se) - No amounts of this element exceeding the "grounds for rejection" limit of 0.01 mg/l were detected in any composite.

Arsenic (As) - Analyses of all semiannual composites failed to reveal the presence of arsenic. (The procedure used was capable of detecting 0.001 mg As.) The Drinking Water Standards recommendation is 0.01 mg/l.

Copper (Cu) - Examinations for copper, sensitive to 0.02 mg/l, produced negative results. The recommended limit is 1.0 mg/l.

Hexavalent Chromium (Cr) - No traces of hexavalent chromium were discovered by grab sample analyses.

Silica - Results from all stations (for first-half and last-half 1962 composite analyses) substantiate the monthly composite results discussed previously. Bar graphs in Figure 24 indicate that higher runoff in the winter and spring produced greater silica concentrations than during the extended dry weather period from June through December. As usual, Station 4 exhibited the greatest variation (8 to 26 mg/l). Ranges in concentrations for the other stations were from 13 to 18.5 mg/l for the first analyses and between 11 and 12.5 mg/l for the second analyses.



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 24
SILICA CONTENT
SEMIANNUAL COMPOSITE

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ANALYTICAL RESULTS - SPECIAL STUDIES

General - Although numerous non-routine water quality examinations have been conducted since the project began, only two such studies will be reported here. These are the carbon filter extract studies and the 24-hour diurnal water quality variation. Results obtained thus far are considered insufficient and will be augmented for inclusion in a supplemental report.

Organics Sampling (Carbon Filter) - Organics sampling units of the carbon filter type (Figures 25 and 26) were installed at all stations. Installations at tributary stream stations were completed by mid-year, but construction activities at the damsite delayed until November the completion of a unit at Station 1. After sampling procedures were established according to current practices of the Public Health Service National Water Quality Network, initial runs at Stations 2 and 4 were begun. These first runs were extended over a period of several months in order to depict long term average concentrations. Difficulty maintaining continuous operation was experienced at all stations due to clogging of valves, water level falling below intake elevations, etc. However, most of these "break-in" hindrances have now been corrected.

It was felt initially that runs approaching 5000 total gallons filtered might exceed maximum carbon adsorption ability. Because of this, lesser amounts of raw water were filtered during the latter part of the year for comparison. The limited number of results illustrated in Figure 27 show that greater carbon chloroform extract (CCE) concentrations were reported when gallons

41a

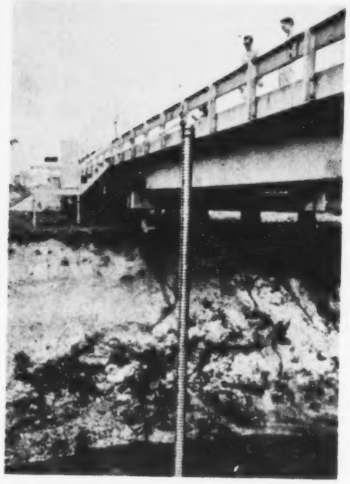


Figure 25. Carbon filter sampling unit - Pelahatchie Creek.

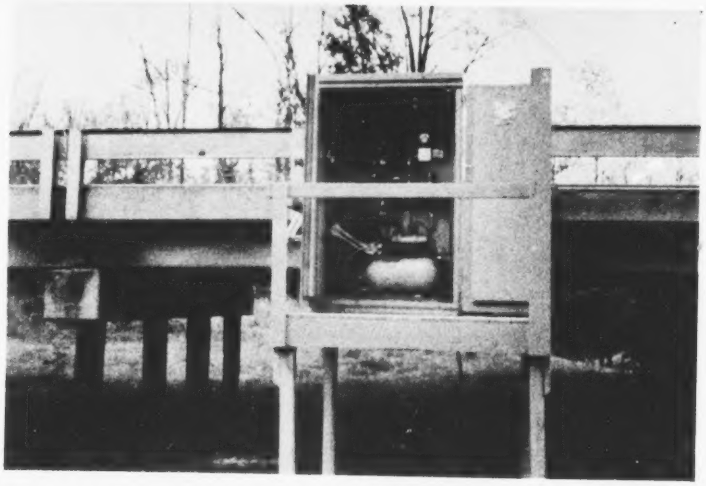
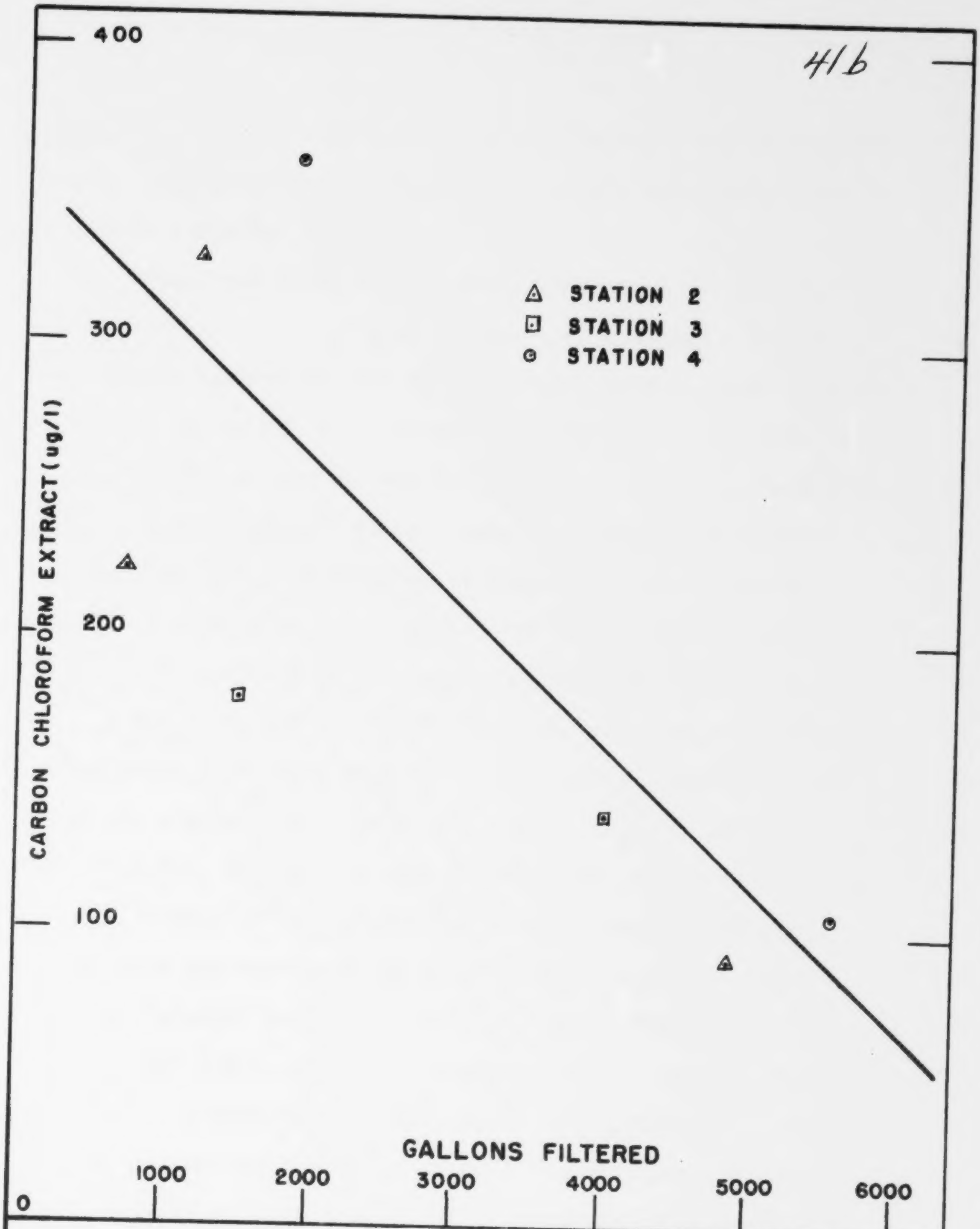


Figure 26. Interior of carbon filter sampling unit.

41b



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 27
CCE CONCENTRATION VS
GALLONS FILTERED

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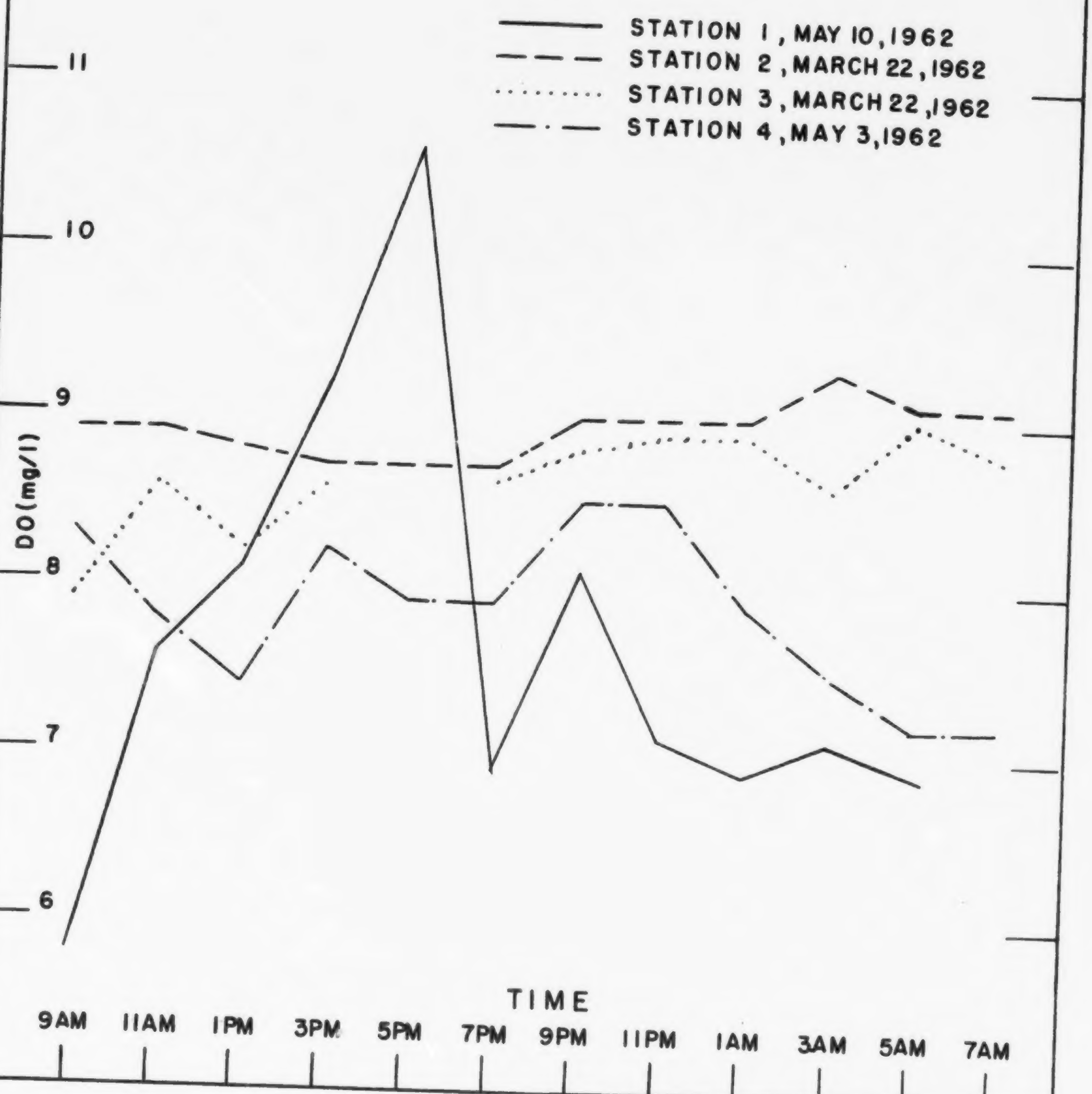
filtered were least. Maximum adsorption, then, is probably exceeded during long runs. Further studies will be made concerning carbon adsorption ability.

Comparison of CCE results among the various stations will not be made at this time due to limited data available. However, it might be pointed out that the recommended Drinking Water Standards limit for CCE is 200 ug/1. This was exceeded during most runs of less than 2000 gallons filtered but not during the three longer runs.

24-Hour Studies - Diurnal variation studies were conducted at Stations 2 and 3 on March 22, at Station 4 on May 3, and at Station 1 on May 10. It was not possible to repeat these studies during the drought period but further data will be obtained in 1963.

The characteristics of DO, BOD, coliform (MPN), and fecal streptococci (MPN) were studied. In addition, the membrane filter technique was employed at Station 4 for both coliform and fecal streptococci. Figures 28.a. through 28.d. show some of the results.

As expected, the effects of photosynthesis on dissolved oxygen were not evident in the March studies. By May, however, a definite increase in DO values were observed at Station 1 during the daylight hours. Diurnal DO variation was less pronounced at Station 4. Concentrations ranged from 5.8 to 10.6 mg/1 (70 to 120 percent saturation) from 9:00 a.m. to 5:00 p.m. Data reported from the other two stations were relatively constant at approximately 90 percent of saturation.



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 28A

24-HOUR STUDIES, D O

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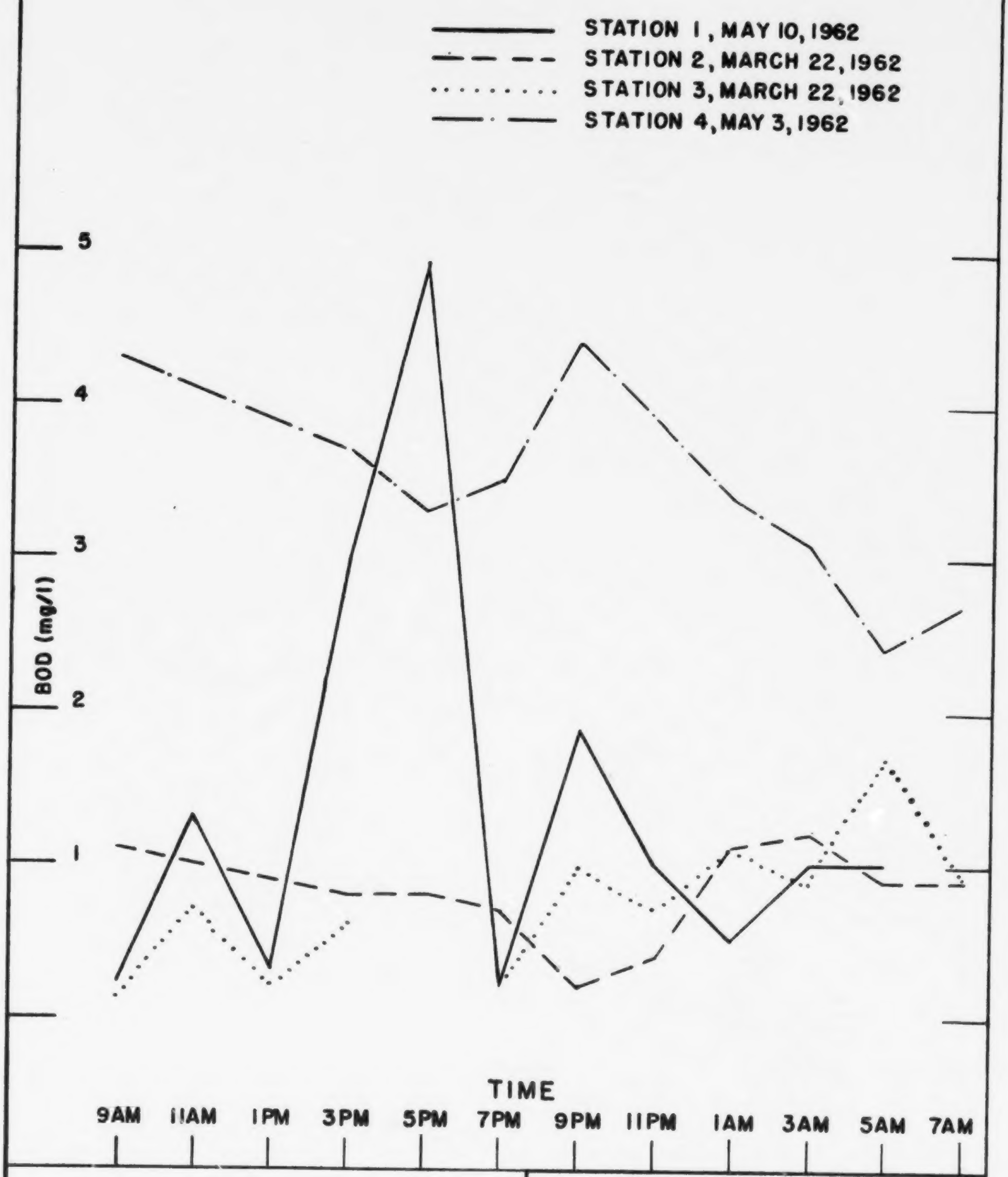

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 28B

24-HOUR STUDIES, BOD VARIATION

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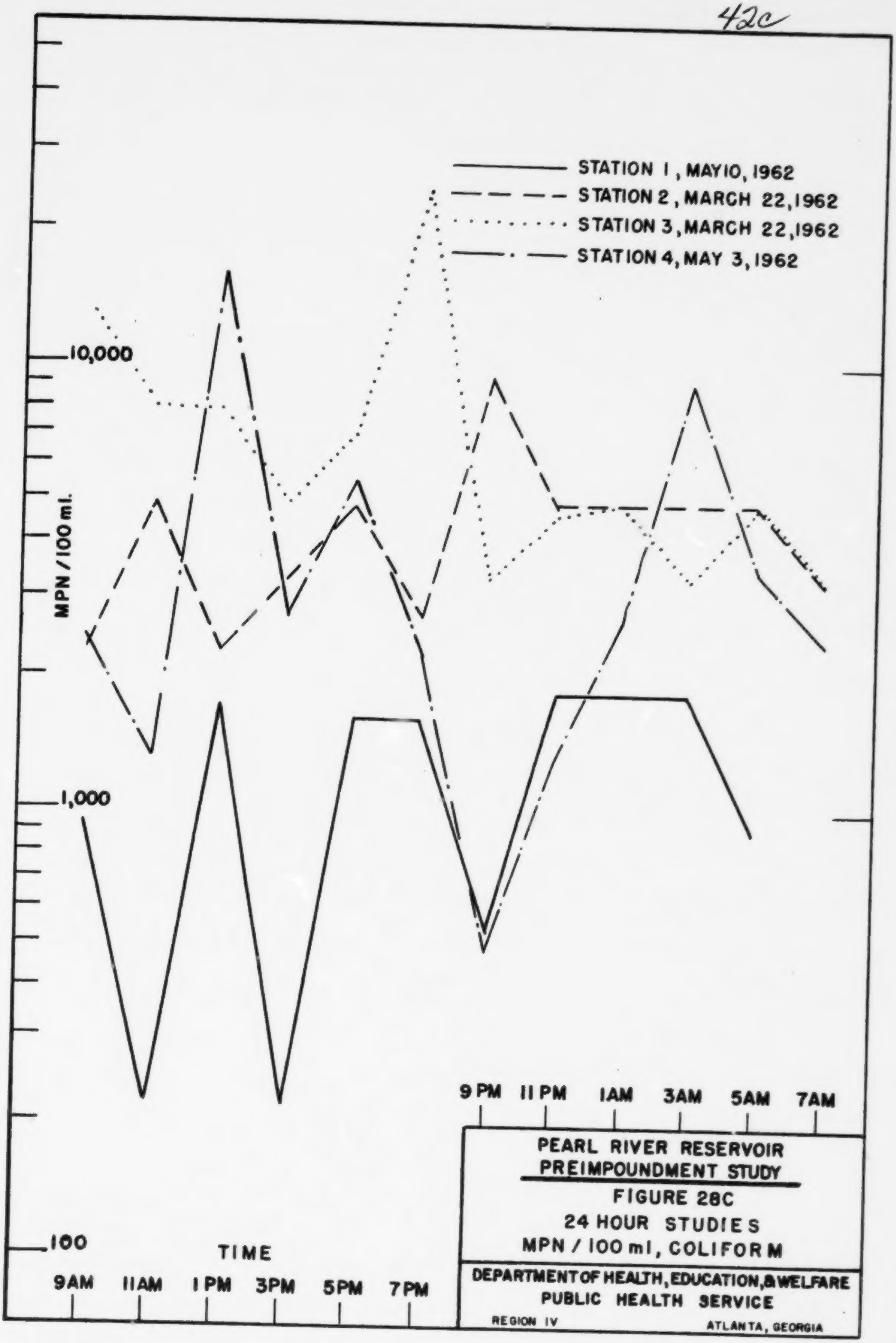

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 28C
24 HOUR STUDIES
MPN / 100 ml, COLIFORM

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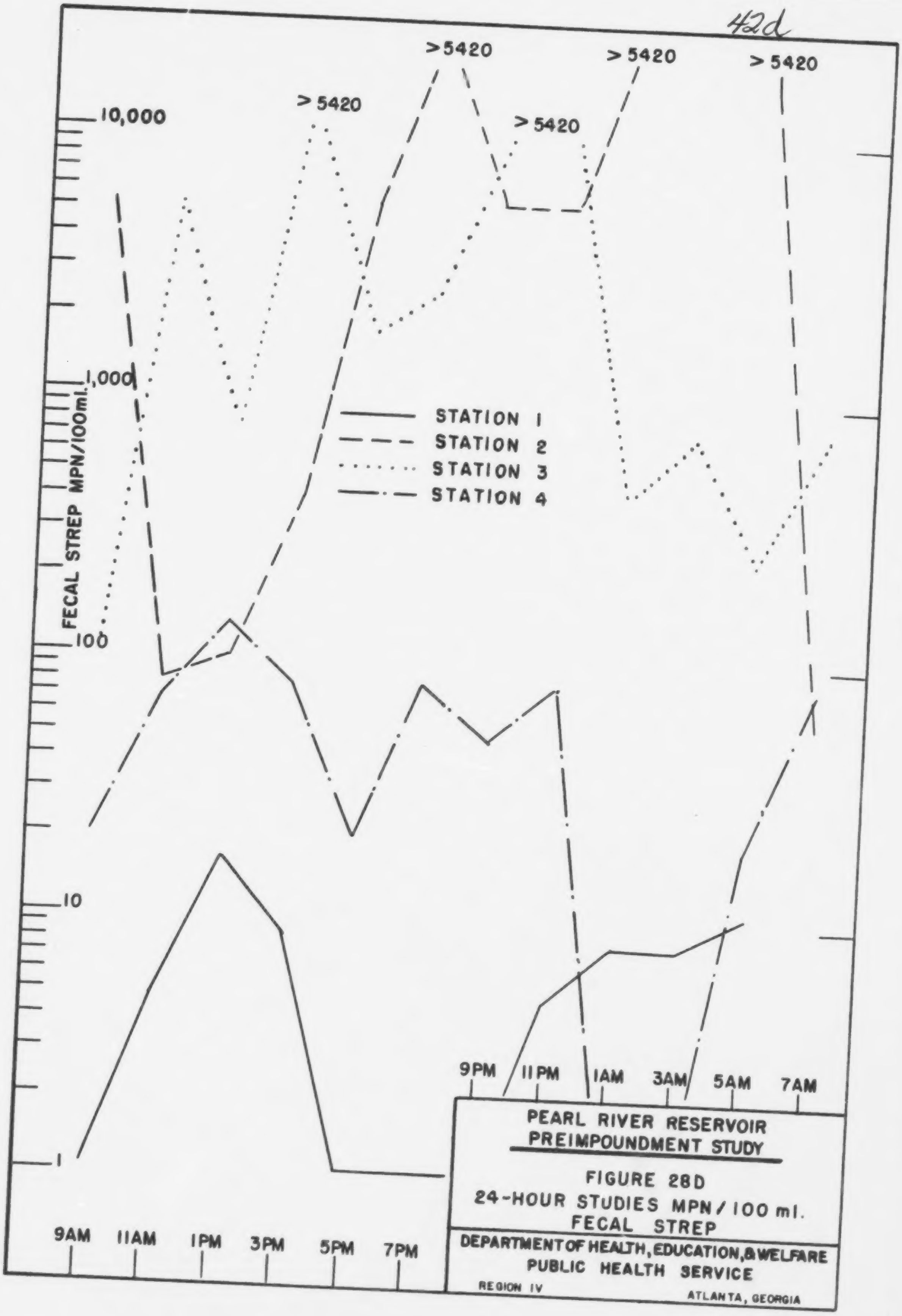

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE 28D
24-HOUR STUDIES MPN / 100 ml.
FECAL STREP

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Biochemical oxygen demand was highest at Pelahatchie Creek and ranged from 2.5 to 4.3 mg/l. At the other three stations, BOD was usually near 1.0 mg/l with one exception. Peak BOD values during the daylight hours for Station 1 are attributed to the high algal cell concentrations present.

The results of bacteriological examination are depicted in Figure 28.c and 28.d. The data are limited and further information will need to be obtained. Hour-to-hour results reflect normal variability of the MPN determination with grab sampling.

Future diurnal variation surveys will include more analyses concerning the water quality constituents of the first studies. Examination of nitrogen cycle and other important characteristics will also be included.

DISCUSSION

GENERAL

Water analyses data obtained during the preimpoundment study have depicted water quality at the Pearl River Reservoir damsite and on the three major tributaries. It must be realized however that continuing studies are expected to more thoroughly examine certain quality characteristics such as nitrogen compounds, coliform fecal streptococci, and dissolved oxygen. Diurnal variations of these characteristics will be of particular importance. Carbon chlorofrom extract studies will also be expanded to determine the relative importance of this constituent.

When the impoundment phase of the study begins (possibly by early 1964), it will be possible and necessary to reduce the number of analyses at the tributary stream stations (Stations 2. 3, and 4). Those characteristics such as hardness, calcium, magnesium, chloride, and others showing relatively constant values will be examined less frequently. Seasonal examinations of water quality will be made on the tributaries but the present analysis schedule will be maintained for the damsite sampling station (Station 1).

From the inventories of waste sources, important data have been obtained concerning relationships between pollutional discharges and water quality at the sampling stations. These inventories will be updated on an annual basis or when significant water quality changes are detected.

VALIDITY OF RESULTS

With few exceptions the accuracy of analyses data reported are considered very reliable. Methods of ascertaining reliability included duplicate sampling and analysis, participation in the Analytical Reference Service of the Public Health Service, and comparison with a different chemist's results. As previously discussed, there is some question as to the validity of results of analyses performed on the longer-storage composites for nitrates, phosphates, and certain other constituents. Every precaution for sample preservation was observed however, and further study is being made to determine possible deterioration of samples during storage. The detailed results of validity studies will be presented in subsequent reports.

Concerning the statistical interpretations presented in the RESULTS section, it is felt that additional data are needed to further define the patterns and distribution of parameter values. These additional data will be for Stations 2 and 4 only inasmuch as limited impoundment has already affected the river at Station 1. Computations of means, standard deviations, correlation coefficients, etc. will be increased as additional data are obtained, and these will also be included in supplemental reports.

Comparisons were made between present analysis information and previous data available for the Pearl River above and at the Jackson water plant. Water quality examinations which were made (some as far back as 11 years) by the City of Jackson and the U. S. Geological Survey reported results for various chemical, physical.

and bacteriological characteristics. These results, though few, fell within the range of values obtained during the preimpoundment study. This indicates that 1962 was a representative period.

EXISTING WATER QUALITY

General - Water quality at the four sampling stations was very similar in many respects. This would be expected since the geology of the watershed is uniform and since the effects of waste discharges are substantially reduced through assimilative mechanisms before they reach sampling locations. Station 4, Pelahatchie Creek, consistently reported the poorest water quality values. This stream receives proportionately higher amounts of municipal and industrial waste discharges and is extremely sluggish during low flow periods.

Drinking Water - The major use of water from the Pearl River Reservoir will be for the Jackson water supply system. At present the quality of Pearl River (Station 1) water for drinking water purposes is good, although contingent upon adequate treatment, i.e., coagulation, sedimentation, filtration, and chlorination. The average coliform concentration at Station 1 was within the 5000 MPN per 100 ml level recommended in PHS Bulletin 296 Manual of Recommended Water Sanitation Practice for Group III raw waters requiring complete rapid-sand filtration treatment or its equivalent. Levels for chemical constituents have not been set, but in comparing analyses results with the 1962 Public Health Service Drinking Water Standards, the raw water values for iron and carbon chloroform extract exceeded the established finished water limits on numerous occasions. For color, turbidity, and coliform counts, analyses values always surpassed Drinking Water Standards limits, but this is to be expected in the raw water of a surface stream. At the present time, the City of Jackson water plant is capable of reducing all five of the above constituents to acceptable finished water concentration levels. This reduction is accomplished through the conventional treatment devices of coagulation with alum and lime, mechanical mixing, sedimentation, rapid-sand filtration, and disinfection with chloramines. Activated carbon treatment is employed for taste and odor control when needed, and pH is adjusted to optimum levels for corrosion control (Langlier Index values of raw water are generally calculated in the -2.5 range).

Recreation - From the standpoint of water contact sports, bacteriological and toxic qualities of water are major considerations. No known toxic elements examined were detected in harmful concentrations. It is planned that analyses for certain insecticides, such as for the heptachlor used extensively in fire ant control, will be included in future analysis programs. This work would be part of the continuing Public Health Service program relating to the ultimate fate and effect of insecticides applied to land.

Although no exact bacteriological limits have been generally set for waters used for aquatic sports, it is generally agreed that recreational areas should be as remote as possible from fecal pollution sources. The headwaters of the Pearl River Reservoir are located in an area which is approximately 28 miles from the closest untreated waste outfall (Kosciusko) and 7 miles from the closest treated waste source (Carthage). Bacteria counts in this area were generally higher than at Stations 1 and 4. "In both the United States and Canada, a coliform index of 1000 per 100 ml has received wide acceptance as a reasonable dividing line, with values below considered safe under average conditions and those above considered unsafe (for swimming and bathing waters)."1/ Analysis results averaged greater than this limit at all stations.

Industrial Water - Conventional treatment methods such as employed by the City of Jackson water works would be adequate for most industrial water uses. The major problem of concern to large industrial users in the Pearl River Reservoir area is one of dependable annual supply. It is anticipated that construction of the reservoir will minimize these water quantity problems to a large extent.

EFFECTS OF IMPOUNDMENT

From the 1962 preimpoundment study results, a limited number of predictions can be made concerning water quality in the Pearl River Reservoir after impoundment. Detailed prognostications are not warranted at this time because of limited knowledge available on shallow water reservoirs and on recreational effects.

Some turbidity and coliform bacteria reduction is anticipated as soon as impoundment begins. These reductions will not be so evident at tributary entrances but will occur after sufficient

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1/ Water Quality Criteria, p. 160, California Water Pollution Control Board, Publication No. 3, 1957.

storage time. Whether or not average coliform counts will decline below 1000 MPN per 100 ml levels at tributary inlets is not known. Provision of additional municipal waste treatment systems is expected to help. Temperatures will be stabilized and stratification layers may occur for temperature, dissolved oxygen, and other characteristics as well.

One of the original objectives of the study was to determine the nuisance algal bloom potential and possible related taste and odor problems. Considerable data concerning available nutrients for algal growth were obtained through routine chemical analyses. Oxygen was found to be above 80 percent saturation during most of the year on the major tributaries. Phosphorus compounds in amounts between 50 and 100 parts per billion were reported. Average pH values in the neutral range are well defined. Free carbon dioxide is usually present in amounts of two to five ppm.

The environmental control of the Pearl River Valley Water Supply District will be an important contributing factor for insuring good water quality for all future uses. Satisfactory sewage and refuse disposal regulations for shoreline developments and for use of watercraft must be adopted. Sufficient authority for water quality control has been vested in the District and the Mississippi State Board of Health.

Some future increases in certain mineral constituents (such as manganese) may result from leaching of inundated lands. The reservoir bottom will generally be composed of a top stratum in the alluvial valley of sands and silty-clays. Some of the deposits will be found in meander belts. Occasionally, areas of substratum consisting of sand and gravel will be exposed to the surface and consequently the reservoir bottom. On the marginal slopes of the valley, weathered Yazoo clay, the base formation, may be found exposed. This clay, in its weathered state, contains black manganese oxide stains in the joints. Organic material remaining from land clearing operations consists of burned timber (usually that which was not readily marketable) and vegetative regrowth developing between clearing and filling periods. Odor problems developing from decaying vegetation will occur to some degree.

APPENDICES

APPENDIX A - THE PEARL RIVER VALLEY WATER SUPPLY DISTRICT ACT

Mississippi Legislature
Regular Session, 1958

SENATE BILL NO. 1724

AN ACT to declare the public necessity of creating a governmental subdivision of the state to be known as the Pearl River Valley Water Supply District; to provide for the creation of such water supply district; to authorize such district to construct, own and operate reservoirs and dams to insure adequate water supply for domestic, municipal, commercial, industrial, agricultural and manufacturing purposes, and recreational uses; to authorize such district to perform, and to assist and cooperate with agencies of the federal government or of the state or any political subdivision thereof in performing, water conservation, flood control, pollution abatement, timber conservation, and irrigation work; to provide for the further powers and duties of such district; to provide for the financing of such district; to authorize such district to issue bonds and to provide for the payment of such bonds.

Be it enacted by the Legislature of the State of Mississippi:

Section 1. Short Title. This Act may be cited as the Pearl River Valley Water Supply District Act.

Section 2. Legislative determination and declaration of policy. (a) It is hereby declared, as a matter of legislative determination, that the waterways and surface waters of the state are among its basic resources, that the overflow and surface waters of the state have not heretofore been conserved to realize their full beneficial use, that the preservation, conservation, storage and control of such waters are necessary to insure an adequate, sanitary water supply at all times, to promote the balanced economic development of the state and to aid in flood control, conservation and development of state forests, irrigation of lands needing irrigation and pollution abatement. It is further determined and declared that the preservation, conservation, storage and control of the waters of the Pearl River and its tributaries and its overflow waters for domestic, municipal, commercial, industrial, agricultural and manufacturing purposes, for recreational uses, for flood control, timber development, irrigation and pollution abatement are, as a matter of public policy, for the general welfare of the entire people of the state.

(b) That the creation of the Pearl River Valley Water Supply District is determined to be necessary and essential to the accomplishment of the aforesaid purposes and that this Act operates on a subject in which the state at large is interested. All the terms and provisions of this Act are to be liberally construed to effectuate the purposes herein set forth, this being a remedial Act.

Section 3. General Authority to organize. The Pearl River Valley Water Supply District may hereafter be organized in this state under the provisions of this article, in the manner herein after provided for. This Water Supply District shall be an agency of the State and a body politic and corporate, and may be composed of one or more entire counties.

Section 4. BOARD OF DIRECTORS. All powers of the District shall be exercised by a Board of Directors, to be composed of the following:

(a) Each member of the Pearl River Industrial Commission whose county becomes a part of the Pearl River Valley Water Supply District shall be a member of the Board of Directors of the Pearl River Valley Water Supply District. Such directors shall serve on this Board during their term of office on the Pearl River Industrial Commission. In addition the Board of Supervisors of each county which becomes a part of the District shall appoint one additional member.

(b) The Board of Water Commissioners, the State Game and Fish Commission, Forestry Commission and the State Board of Health of the State of Mississippi shall each appoint one director from that Department to serve on the Board of Directors of the Pearl River Valley Water Supply District to serve at the pleasure of the respective board appointing him.

(c) Each director shall take and subscribe to the oath of office, required by Section 268 of the Constitution of the State of Mississippi before a Chancery Clerk, that he will faithfully discharge the duties of the office, which oath shall be filed with the said Clerk and by him preserved.

(d) Each director shall receive a fee of not to exceed Fifteen Dollars ($15.00) per day for attending each meeting of the Board and for each day spent in attending to the necessary business of the District and to reimbursement for actual expenses thus incurred upon express authorization of the Board.

(e) The Board of Directors shall annually elect from its number a president and a vice-president of the District, and such other officers as in the judgment of the Board are necessary. The president shall be the chief executive officer of the District and the presiding officer of the Board, and shall have the same right to vote as any other Director. The vice-president shall perform all duties and exercise all powers conferred by this Act upon the president when the president is absent or fails or declines to act except the president's right to vote. The Board shall also appoint a secretary and a treasurer who may or may not be members of the Board, and it may combine those offices. The treasurer shall give bond in the sum of not less than Fifty Thousand Dollars ($50,000.00) as set by the Board of Directors and each Director shall give bond in the sum of not less than Ten Thousand Dollars ($10,000.00), and the premiums on said bonds shall be an expense of the District. The condition of each such bond shall be that the treasurer or Director will faithfully perform all duties of office and account for all money which shall come into his custody as treasurer or Director of the District.

Section 5. Creation of district, petition. The Pearl River Industrial Commission, acting through its members who favor bringing the counties they represent into the Pearl River Valley Water Supply District, shall petition the chancery court of the First Judicial District of Hinds County to organize and establish the Pearl River Valley Water Supply District and shall set forth in the petition:

(a) The counties to be included in the Pearl River Valley Water Supply District. Any county through which the Pearl River runs or which borders on the Pearl River may be included in the District.

(b) The fact that a preliminary report or study to determine the engineering feasibility of constructing a dam and reservoir in the basin of Pearl River has been made by a competent engineer or engineering firm and that such study or report shows that the construction of such facilities is feasible for water conservation or supply or for any of the other purposes or services contemplated by the legislative declaration of public policy in this Act.

(c) The necessity and desirability for the construction of such facilities.

(d) A general description of the purposes of the contemplated works, and a general description of the plan including the lands to be overflowed or otherwise affected thereby, and maps or plats showing the general location of the reservoir and dam and related facilities. The word "project" when used herein shall mean the general plan and purposes of the Pearl River Valley Water Supply District, including its physical properties, as set out in this petition to the Chancery Court and the words "project area" shall mean the physical location of the reservoir, dam and related facilities as shown on the plats filed with the Chancery Court and shall include and be limited to an area of one (1) mile from the shore line of the reservoir at high water. The words "related facilities" as used in this Act shall mean the facilities indicated on said maps or plats filed with the Chancery Court or otherwise explained in the pleadings filed with the Chancery Court and shall include property, land or areas of land, adjacent to, or in the vicinity of, said reservoir or dam and within a distance of one (1) mile from the high water mark of the proposed shore line of said reservoir as shown on said map, which may be acquired, owned, rented, leased or sold by the District in connection with the recreational or industrial development and use of the Project.

The petition shall be filed with as many copies as there are parties defendant. A copy of the preliminary report or study shall be attached to the original and each copy of the petition as an exhibit.

The Board of Water Commissioners shall be made a party defendant, and the Chancery Clerk shall furnish the Board of Water Commissioners with a copy of the petition with attached exhibits. Each county named in the Petition shall be joined as a party defendant by service of process on the president of the Board of Supervisors thereof, and the Chancery Clerk shall furnish a copy of the petition to each such President. Whenever any municipality having a population according to the most recent Federal Census of ten thousand (10,000) or more is included in such proposed district, such municipality shall be made a party defendant.

It shall not be necessary that any land owners in the counties to be included in said proposed district be named in the petition, or made parties defendant. The chancellor of the chancery court of the First Judicial District of Hinds County, Mississippi, shall have jurisdiction of the entire water supply district and project area for the purposes of this Act. Such jurisdiction may be exercised by the chancellor in term time or in vacation, as provided in this Act.

Section 6. Proceedings after petition filed. The Board of Water Commissioners shall make a written report on the preliminary study or plans furnished them, and shall within thirty (30) days after receipt of the said study file such report with the Chancery Court setting forth their recommendations concerning the proposed water supply district. After the filing of the report of the Board of Water Commissioners, and upon motion of the petitioners, the chancellor shall enter an order fixing the date for a hearing of the cause on the original petition, the exhibit, the report and recommendations of the Board of Water Commissioners and any answers filed or other pleadings. The chancery clerk shall give notice of such hearing to all persons interested by posting notices thereon at the door of the courthouse of the county or couties in which the district is situated, and in at least ten public places in said proposed district, and also by publishing said notice at least once a week for three consecutive weeks in a newspaper published in Hinds County and in a newspaper published in each of the other counties proposed to be included in such water supply district. If there is no newspaper published in any such county, then it shall be sufficient to publish said notice in a newspaper having a general circulation in such county. Such notice shall be addressed to the property owners and qualified electors of such proposed district and all other persons interested, shall state when and in what court said petition was and is filed, shall state the counties included in such district, and shall command all such persons to appear before the chancery court, or the chancellor in vacation, at the Chancery Court Building in the First Judicial District of Hinds

County, upon the date fixed by the chancellor, to show cause, if any they can, why the proposed water supply district should not be organized and established as prayed for in said petition. The date for such hearing shall not be less than twenty-one (21) days nor more than forty (40) days after the last publication of such notice. It shall be sufficient in describing the lands to be included in the water supply district to name the counties to be included therein in the publication or notice hereinbefore mentioned.

If the court or chancellor finds that the notice or publication was not given as provided for in this Act, it shall not thereby lose jurisdiction, but the court or chancellor shall order due publication or notice to be given and shall continue the hearing until such publication or notice shall be properly given, and the court or chancellor shall thereupon proceed as though publication or notice had been properly given in the first instance.

Section 7. Hearing. The chancery court of the First Judicial District of Hinds County may hear the petition at any term thereof, or the chancellor of said court may fix a time to hear such petition at any time in vacation, and may determine all matters pertaining thereto, and may adjourn the hearing from time to time, and may continue the case for want of sufficient notice or other good cause. And if said petition shall prove defective in any manner, the petitioners, upon motion, shall be permitted to amend the same.

Section 8. How petition passed upon. Upon the day set for hearing said petition, or a day to which same may be continued by the court or chancellor, all parties interested may appear and contest the same. If upon the hearing of such petition, it is found that such project is feasible from an engineering standpoint and practical, and if the creation of the water supply district under the terms of this Act would meet a public necessity both local and statewide and would be conducive to the public welfare of the state as a whole, such court or chancellor shall so find and shall make and enter an order upon the minutes of the said chancery court stating that the said district to be known as the Pearl River Valley Water Supply District, should be organized subject to all of the terms and provisions of this Act.

If the chancellor finds that the proposed water supply district should not be organized, he shall dismiss the proceedings and the costs shall be paid by the Pearl River Industrial Commission.

If the court or chancellor thereof finds that the proposed water supply district should be organized, the chancellor shall then order an election in each county in the proposed district, which election shall be held not less than twenty-one (21) nor more than forty-five (45) days from the date of such order whereby the qualified electors within such counties may determine if such county shall be a part of such proposed district and such order for an election shall be interlocutory and not appealable. A substantial copy of the court order shall be published once a week for at least three (3) consecutive weeks, in at least one newspaper published in each county in such district. If there is no newspaper published in any such county, then it shall be sufficient to publish said notice in a newspaper having a general circulation in such county, and, in addition, by posting a copy of such notice for at least twenty-one (21) days following the issuance of such order at three (3) public places in such county. Notice of the election shall be given by publishing a substantial copy of the court order providing for the election once a week for at least three (3) consecutive weeks, in at least one newspaper published in each county in which an election is to be held. The first publication of such notice shall be made not less than twenty-one (21) days prior to the date fixed for such election. If no newspaper is published in any such county, then such notice shall be given by publishing the same for the required time in some newspaper having a general circulation in such county, and, in addition, by posting a copy of such notice for at least twenty-one (21) days next preceding such election at three (3) public places in such county.

Section 9. Election--how held. Such election shall be held as far as is practicable, in the same manner as other elections are held in counties. At such election, all qualified electors of such counties may vote and the ballots used at such election shall have printed thereon the words "FOR BEING INCLUDED IN THE PEARL RIVER VALLEY WATER SUPPLY DISTRICT" and "AGAINST BEING INCLUDED IN THE PEARL RIVER VALLEY WATER SUPPLY DISTRICT" and the voter shall vote by placing a cross (X) or check mark (v) opposite his choice on the proposition. In any particular county, should a majority of the qualified electors voting in such election in such county vote in favor of the creation of the Pearl River Valley Water Supply District then that county shall become a part of the water supply district. The chancery court of the First Judicial District of Hinds County or the chancellor thereof in vacation shall thereupon enter a final order including such county in the district. In any particular county, should a majority of the qualified electors voting in such election in such county vote against being included in the Pearl River Valley Water Supply District, then that county shall not become a part of the Water Supply District.

Section 10. Appeals--Preference case. Any person interested in or aggrieved by the final order of the court or the chancellor, creating the water supply district or dismissing the petition or admitting a county to the district, and who was a party to the proceedings in the chancery court, may prosecute an appeal therefrom within ten (10) days from the date of such decree by furnishing an appeal bond in the sum of Five Hundred Dollars ($500.00) with two good and sufficient sureties, conditioned to pay all costs of the appeal in the event the decree is affirmed. Such appeal bond shall be subject to the approval of the chancery clerk. When the transcript of the record of the case shall be filed in the office of the Supreme Court, the appellee having been summoned to appear and answer the appeal, ten (10) days after service of the summons on appellee or his attorney, the court shall consider such case as entitled to be heard. Any part to any proceeding in any court involving any of the provisions of this Act may waive any time for filing pleadings so as to obtain an earlier hearing.

Any appeal from such order or decree of the chancery court or chancellor shall be a preference case in the Supreme Court and shall be tried at the earliest moment convenient with said court.

Section 11. Powers of District. The Pearl River Valley Water Supply District through its board of directors is hereby empowered:

(a) To impound overflow water and the surface water of the Pearl River or its tributaries within the project area within or without such district at such place or places and in such amount as may be approved by the Board of Water Commissioners of the State of Mississippi, by the construction of a dam or dams, reservoir or reservoirs, works, plants and any other necessary or useful related facilities contemplated and described as a part of the project within or without the District, to control, store and preserve such waters, and to use, distribute, and sell the same. The Pearl River Valley Water Supply District is also empowered to construct or otherwise acquire within the project area, all works, plants, or other facilities necessary or useful to the project for the purpose of processing such water and transporting it to cities and others for domestic, municipal, commercial, industrial, agricultural and manufacturing purposes and is hereby given the power to control open channels for water delivery purposes.

(b) To acquire and develop any other available water necessary or useful to the project and to construct, acquire, and develop all facilities within the project area deemed necessary or useful with respect thereto.

(c) To prevent or aid in the prevention of damage to person or property from the waters of the Pearl River or any of its tributaries.

(d) To forest and reforest, and to aid in the foresting and reforesting of the project area, and to prevent and to aid in the prevention of soil erosion and floods within said area; to control, store and preserve within the boundaries of the project area the waters of the Pearl River or any of its tributaries, for irrigation of lands and for prevention of water pollution.

(e) To acquire by purchase, lease, gift or in any other manner (otherwise than by condemnation) and to maintain, use and operate any and all property of any kind, real, personal or mixed, or any interest therein within the project area, within or without the boundaries of the District, necessary for the project and convenient to the exercise of the powers, rights, privileges and functions conferred upon the District by this Act.

(f) To acquire by condemnation any and all property of any kind, real, personal or mixed, or any interest therein, within the project area not exceeding one quarter mile from the outside line of the 300 foot above sea level contour on each side of Pearl River except as provided for rights of way under Subsection (g) of this section, within or without the boundaries of the District necessary for the project and the exercise of the powers, rights, privileges and functions conferred upon the District by this Act, according to the procedure provided by law for the condemnation of lands or other property taken for rights of way or other purposes by railroads, telephone or telegraph companies. For the purposes of carrying out this Act the right of eminent domain of such District shall be superior and dominant to the right of eminent domain of railroad, telegraph, telephone, gas, power and other companies or corporations and shall be sufficient to enable the acquisition of county roads, state highways or other public property in the project area, and the acquisition, or relocation, of the above mentioned utility property in the project area; provided however that Mississippi Highway 43 as presently located shall be kept open as part of the State Highway system. The cost of right-of-way purchases, re-routing, and/or elevating all other county maintained roads affected by construction of the said reservoir shall be borne by the said water district and new construction shall be of equal quality as in roads existing at the time of passage of this Act.

The amount and character of interest in land, other property and easements thus to be acquired shall be determined by the Board of Directors and their determination shall be conclusive and shall not be subject to attack in the absence of manifold abuse of discretion or fraud on the part of such Board in making such determination. Provided, however,

(1) In acquiring lands, either by negotiation or condemnation, the District shall not acquire minerals or royalties within the project area; sand and gravel shall not be considered as minerals within the meaning of this section; and

(2) No person or persons owning the drilling rights or the right to share in production shall be prevented from exploring, developing or producing oil or gas, with necessary rights of way for ingress and egress, pipe lines and other means of transporting such products by reason of the inclusion of such lands or mineral interests within the project area, whether below or above the water line, but any such activities shall be under such reasonable regulations by the Board of Directors as will adequately protect the reservoir; and

(3) In drilling and developing, such persons be and are hereby vested with a special right to have such mineral interests integrated and their lands developed in such drilling unit or units as the State Oil and Gas Board shall establish after due consideration of the rights of all of the owners to be included in the drilling unit.

Provided further that where any site or plot of land is to be rented, leased or sold to any person, firm or corporation for the purpose of operating recreational facilities thereon for profit, then the Board shall, by resolution, specify the terms and conditions of such sale, rental or lease, and shall advertise for public bids thereon. When such bids are received, the same shall be publicly opened by the Board, and the Board shall thereupon determine the highest and best bid submitted, and shall immediately notify the former owner of such site or plot of the amount, terms and conditions of such highest and best bid. Such former owner of such site or plot shall have the exclusive right at his option, for a period of thirty (30) days after the determination of the highest and best bid by the Board, to rent, lease or purchase said site or plot of land, by meeting such highest and best bid, and by complying with all terms and conditions of such renting, leasing or sale, as specified by the Board; provided, however, the Board shall not in any event, rent, lease or sell to any former owner more land than was taken from such former owner for the construction of the project, or one-quarter mile of shore-line, whichever shall be the lesser. If such option is not exercised by such former owner within said period of thirty (30) days, then the Board shall accept the highest and best bid submitted.

(g) To require the necessary relocation of roads and highways, and railroad, telephone and telegraph lines and properties, electric power lines, gas pipe lines and mains and facilities in the project area or to require the anchoring or other protection of any of these, provided, due compensation is first paid the owners thereof, or agreement is had with such owners regarding the payment of the cost of such relocation. It is further provided that the District is hereby authorized to acquire easements or rights of way in or outside of the project area for the relocation of such roads, highways, railroad, telephone and telegraph lines and properties, electric power lines, gas pipe lines and mains and facilities and to convey the same to the owners thereof in connection with such relocation as a part of the construction of the project; provided, however, the directors of the District shall not close any public access road to the reservoir existing prior to the construction of the reservoir unless the Board of Supervisors of the county in which such road is located agrees thereto.

(h) To overflow and inundate any public lands and public property, including sixteenth section lands, and in lieu lands within the project area.

(i) To construct, extend, improve, maintain and reconstruct, to cause to be constructed, extended, improved, maintained and reconstructed, and to use and operate, any and all facilities of any kind within the project area necessary or convenient to the project and to the exercise of such powers, rights, privileges and functions;

(j) To sue and be sued in its corporate name;

(k) To adopt, use and alter a corporate seal;

(l) To make by-laws for the management and regulation of its affairs;

(m) To employ engineers, attorneys, and all necessary agents and employees to properly finance, construct, operate and maintain the project and the plants and facilities of the District and carry out the provisions of this Act and to pay reasonable compensation for such services; for all services in connection with the issuance of bonds as provided in this Act, the attorney's fee shall not exceed one quarter of one per cent (1/4 of 1%) of the principal amount of said bonds. For any other services, only reasonable compensation shall be paid for such other services. The board shall have the right to employ a general manager, who shall, at the discretion of the board, have the power to employ and discharge employees. Without limiting the generality of the foregoing, it may employ fiscal agents or advisors in connection with its financing program and in connection with the issuance of its bonds.

(n) To make contracts and to execute instruments necessary or convenient to the exercise of the powers, rights, privileges and functions conferred upon it by this Act;

(o) To make or cause to be made surveys and engineering investigations relating to the project, or related projects, for the information of the District, to facilitate the accomplishment of the purposes for which it is created.

(p) To apply for and accept grants from the United States of America, or from any corporation or agency created or designated by the United States of America, and to ratify and accept applications heretofore or hereafter made by voluntary associations to such agencies for grants to construct, maintain or operate any project or projects which hereafter may be undertaken or contemplated by said District;

(q) To do any and all other acts or things necessary or convenient to the exercising of the powers, rights, privileges or functions conferred upon it by this Act or any other Act of law.

(r) To make such contracts in the issuance of bonds as may be necessary to insure the marketability thereof.

(s) To enter into contracts with municipalities, corporations, districts, public agencies or political subdivisions of any kind and others for any services, facilities or commodities which the project may provide. The District is also authorized to contract with any municipality, corporation or public agency for the rental, leasing, or purchase of, or for the operation of the water production, water filtration or purification, water supply and distributing facilities of such municipality, corporation or public agency upon such consideration as the District and such entity may agree. Any such contract may be upon such terms and for such time as the parties may agree, and it may provide that it shall continue in effect until bonds specified therein and refunding bonds issued in lieu of such bonds are paid. Any such contract with any political subdivision shall be binding upon said political subdivision according to its terms and such municipalities or other political subdivisions shall have the power to enter into such contracts, as in the discretion of the governing authorities thereof would be to the best interest of the people of such municipality or other political subdivision and such contracts may include within the discretion of such governing authorities a pledge of the full faith and credit of such political subdivisions for the performance thereof.

(t) To fix and collect charges and rates for any services, facilities or commodities furnished by it in connection with said project and to impose penalties for failure to pay such charges and rates when due.

(u) To operate and maintain within the project area with the consent of the governing body of any city or town located within the District, any works, plants or facilities of any such city deemed necessary or convenient to the accomplishment of the purposes for which the district is created.

(v) Subject to the provisions of this Act, from time to time to lease, sell or otherwise dispose of any property of any kind, real, personal or mixed, or any interest therein, within the project area or acquired outside the project area as authorized in this Act, for the purpose of furthering the business of the District.

(w) When in the opinion of the Board of Directors as shown by resolution duly passed, it shall not be necessary to the carrying on of the business of the District that the District own any lands acquired, then the Board shall advertise such lands for sale to the highest and best bidder for cash, and shall receive and publicly open the bids thereon. The Board shall, by resolution, determine the highest and best bid submitted for such land, and shall thereupon notify the former owner, his heirs or devisees, by registered mail, of the land to be sold and the highest and best bid received therefor, and such former owner, or his heirs or devisees, shall have the exclusive right at his or their option for a period of thirty (30) days in which to meet such highest and best bid and to purchase said property.

(x) Any bona fide, resident householder, actually living or maintaining a residence on land taken by the District by condemnation shall have the right to repurchase not exceeding forty (40) acres of his former land or other available land from the Board of Directors for a price not exceeding the price paid for condemning his land.

Section 12. Construction contracts. All construction contracts by the District, where the amount of the contract shall exceed Two Thousand Five Hundred Dollars ($2,500.00), shall be made upon at least three (3) weeks' public notice by advertisement in a newspaper of general circulation in the District, which notice shall state the thing to be done, and invite sealed proposals, to be filed with the Secretary of the District, to do the work; and in all such cases, before the notice shall be published, the plans and specifications for the work shall be filed with the Secretary of the District and there remain; and the Board of Directors of the District shall award the contract to the lowest bidder, who will comply with the terms imposed by such Board, and enter into bond with sufficient sureties, to be approved by the Board, in such penalty as shall be fixed by such Board, but in no case to be less than the contract price, conditions for the prompt, proper and efficient performance of the contract.

Section 13. Park and recreation facilities. The Pearl River Valley Water Supply District is authorized to establish or otherwise provide for public parks and recreation facilities, and for the preservation of fish and wildlife, and to acquire land otherwise than by condemnation except as provided in Section 11 (f) for such purposes, within the project area.

Section 14. Rules and Regulations. (a) The Board of Directors of the District shall have the power to adopt and promulgate all reasonable regulations to secure, maintain and preserve the sanitary condition of all water in and to flow into any reservoir owned by the District, to prevent waste of water or the unauthorized use thereof, and to regulate residence, hunting, fishing, boating, and camping, and all recreational and business privileges, along and around any such reservoir or any body of land, or easement owned by the District.

(b) Such District may prescribe reasonable penalties for the breach of any regulation of the District.

Section 15. Appropriation permit. The District is empowered to obtain through appropriate hearings an appropriation permit or permits from the Board of Water Commissioners of the State of Mississippi, as provided for in Laws 1956, Chapter 167, Section 16 (Section 5956-16 Miss. Code Ann).

Section 16. Water Supply District fund--state tax used for. In each county of the State of Mississippi which is part of the Pearl River Valley Water Supply District, beginning with the ad valorem tax assessment for the calendar year 1960, payable on or before February 1, 1961, and so long as any bonds issued hereunder are outstanding, the tax collector of said county shall pay into the depository selected by said water district for said purpose the amount of two mills of all ad valorem taxes due by said county to the State of Mississippi which is collected by the sheriff and tax collector of said county, which may be collected by any other lawful taxing agency of said county and state and for said county and State of Mississippi shall continue to levy not less than two mills ad valorem taxes on each county in the District so long as any bonds issued pursuant to this Act remain outstanding.

Section 17. Board of Directors to issue bonds. The Board of Directors of the District is hereby authorized and empowered to issue bonds of the District for the purpose of paying the costs of acquiring, owning, constructing, operating, repairing and maintain the projects and works specified herein, including related facilities, and including all financing and financial advisory charges, interest during construction, engineering, legal and other expenses incidental to and necessary for the foregoing, or for the carrying out of any power conferred by this Act. Said Board of Directors is authorized and empowered to issue such bonds at such times and in such amounts as shall be provided for by resolution of the said Board of Directors, not to exceed the limitation prescribed in Section 19 hereof. All such bonds so issued by said District shall be secured solely by a pledge of the net revenues which may now and hereafter come to the District, and by the pledge of the avails of the two (2) mill ad valorem tax levy provided for in Section 16 hereof, and by the pledge of the special tax levy of two (2) mills provided for in Section 20 hereof, and such bonds shall not constitute general obligations of the State of Mississippi, or of the counties comprising said District, and such bonds shall not be secured by a pledge of the full faith, credit and resources of said State or of said counties. Bonds of the District shall not be included in computing any present or future debt limit of any county in such District under any present or future law. "Revenues" as used in this Act shall mean all charges, rentals, tolls, rates, gifts, grants, tax proceeds, moneys and all other funds coming into the possession of the District by virtue of the provisions of this Act, except the proceeds from the sale of bonds issued hereunder. "Net Revenues" as used in this Act shall mean the revenues after payment of costs and expenses of operation and maintenance of the project and related facilities.

Section 18. Details of bonds and sale thereof. All such bonds provided for by Section 17 of this Act shall be negotiable instruments within the meaning of the negotiable instruments law, shall be lithographed or engraved and printed in two (2) or more colors to prevent counterfeiting; they shall be in denominations of not less than one hundred dollars ($100.00) nor more than one thousand dollars ($1,000.00), and shall be registered as issued, and shall be numbered in a regular series from one upward. Each such bond shall specify on its face the purpose for which it was issued and the total amount authorized to be issued, shall be payable to bearer, and the interest to accrue thereon shall be evidenced by proper coupons to be attached thereto. Such bonds shall bear interest at such rate or rates, not exceeding six per cent (6%) per annum as may be determined by the sale of such bonds. They shall mature annually in such amounts and at such times as shall be provided by the resolution of the Board of Directors. Provided, however, that no bond shall have a longer maturity than forty (40) years from January 1, 1961, and the first maturity date thereof shall be not more than five (5) years from to date of such bonds. The denomination, form and place or places of payment of such bonds shall be fixed in the resolution of the Board of Directors of the District. Such bonds shall be signed by the President and the Secretary of such board with the seal of the District affixed thereto, but the coupons may bear only the facsimile signatures of such President and Secretary. All interest accruing on such bonds so issued shall be payable semiannually, except that the first interest coupon attached to any such bond may be for any period not exceeding one year.

Such bonds may be called in, paid and redeemed in inverse numerical order on any interest date prior to maturity, upon not less than thirty (30) days notice to the paying agent or agents designated in such bonds, and at such premium as may be designated in such bonds. Provided, however, that in no case shall any premiums exceed six per cent (6%) of the face value of such bonds.

All such bonds shall contain in substance a statement to the effect that they are secured solely by a pledge of the net revenues of such District, including the avails of the two (2) mill ad valorem tax levy provided for in Section 16 hereof, and the avails of the special tax levy of two (2) mills provided for in Section 20 hereof, and that they do not constitute general obligations of the State of Mississippi, or of the counties comprising said District, and are not secured by a pledge of the full faith, credit and resources of said State or of such counties.

All such bonds as provided for herein shall be sold at public sale as now provided by law. No such sale shall be at a price so low as to require the payment of interest on the money received therefor at more than six per cent (6%) per annum computed with relation to the absolute maturity of the bonds, in accordance with standard tables of bond values, excluding from such computation the amount of any premium to be paid on redemption of any bonds prior to maturity.

This Act shall be full and complete authority for the issuance of the bonds provided for herein, and no restriction or limitation otherwise prescribed by law shall apply herein.

Section 19. Limitation on amount of bonds. Bonds issued pursuant to this Act shall not exceed Twenty-Five Million Dollars ($25,000,000.00) in principal amount.

Section 20. Same--special tax levy, bonds payable from ad valorem taxation. To provide additional funds for the payment of the principal of, interest on and other charges in connection with bonds issued under the provisions of this Act, in the event its anticipated revenue and funds are found to be insufficient therefor by order entered on its Minutes each year that such tax is found necessary, a copy of which order shall be published for two (2) consecutive weeks in a newspaper published in each County of the District thirty (30) days before such levy is made by the Board of Supervisors, the District is also empowered to levy annually a special tax, not to exceed two (2) mills upon all of the taxable property within such District on or before the first Monday of September of each year and shall certify the levy to the boards of supervisors of the various counties in said District, and it shall be the duty of the boards of supervisors to make said levy on each tract of land or other property in said county, according to the assessed valuation thereof. Such taxes shall be collected by the tax collectors of the respective counties in said District who shall deposit them in such depository as shall be selected by the Board of Directors of the District. The tax collector shall receive a sum not greater than one-fifth of one percentum of the amount collected for his services in making such collection. Where bonds are issued payable wholly or partially from ad valorem taxes, it shall be the duty of the Board of Directors to levy a tax sufficient, together with pledged revenues other than the taxes authorized hereunder, to pay the bonds and the interest thereon as such bonds and interest become due, provided that in no event, shall the tax levied exceed two (2) mills. Any part of this levy lost through homestead exemption shall not be reimbursed by the State.

Section 21. Bonds to be incontestable--validation. All bonds issued pursuant to this Act shall be validated as now provided by law by Chapter 1, Title 18, Mississippi Code of 1942. The services of the State's Bond Attorney may be employed in the preparation of such bond resolutions, forms or proceedings as may be necessary, for which he shall be paid a reasonable fee. Such validation proceedings shall be instituted in the Chancery Court of the First Judicial District of Hinds County, Mississippi, but notice of such validation proceedings shall be published at least two (2) times in a newspaper of general circulation and published in each of the counties comprising the Pearl River Valley Water Supply District, the first publication of which in each case shall be made at least ten (10) days preceding the date set for the validation.

Section 22. Trust Agreement. At the discretion of the Board of Directors of the District any bonds provided for in Section 17 of this Act may be further secured by a trust agreement between the Board of Directors and a corporate trustee, which may be any trust company or bank having powers of a trust company within or without the State. Any such trust agreement or any resolution providing for the issuance of such bonds may contain such provisions for protecting and enforcing the rights and remedies of the bondholders as are reasonable and proper and not in violation of law. The trust agreement may contain provision for the issuance of additional bonds for any of the purposes authorized by this Act which shall be secured by the revenues pledged thereunder for such bonds to the extent provided therein. The trust agreement may include provisions to the effect that if there is any default in the payment of principal or interest on any of said bonds, any court having jurisdiction of the action may appoint a receiver to administer the properties and facilities of the District described in the trust agreement on behalf of the District, including authority to sell or make contracts for the sale of any services, facilities or commodities of the District or to renew such contracts, subject to the approval of the Court appointing said receiver; and with power to provide for the payment of such bonds outstanding, or the payment of operating expenses, and to apply the income and revenues to the payment of said bonds and interest thereon in accordance with the resolution of the Board of Directors authorizing the issuance of such bonds and said trust agreement. Provided, however, the fee for the services of any corporate trustee shall not exceed the normal charges for acting as paying agent plus any additional amount or amounts allowed by the court as the reasonable value of services rendered by the corporate trustee upon default in the payment of principal and interest on the bonds.

Section 23. Refunding Bonds. The Board of Directors of the District is hereby authorized to provide by resolution for the issuance of refunding bonds of the District for the purpose of refunding any bonds then outstanding and issued under authority of this Act, including the payment of any redemption premium thereon and any interest accrued or to accrue to the date of redemption of such bonds. The issuance of such refunding bonds, the maturity and other details thereof, and the rights, duties, and obligations of the Board of Trustees and of the District in respect to such bonds shall be governed by the provisions of this Act, insofar as they are applicable. In no event shall such bonds mature over a period of time exceeding forty (40) years from January 1, 1961.

Section 24. Bonds, legal investments. All bonds of the District shall be and are hereby declared to be legal and authorized investments for public funds of counties, cities, towns, school districts, banks, savings banks, trust companies, building and loan associations, savings and loan associations and insurance companies and for funds of the Mississippi Public Employee's Retirement System. Such bonds shall be eligible to secure the deposit of any and all public funds of cities, towns, villages, counties, school districts, or other political corporations or subdivisions of the State of Mississippi; and such bonds shall be lawful and sufficient security for said deposits to the extent of their value, when accompanied by all unmatured coupons appurtenant thereto.

Section 25. Depository for funds of District. (a) The Board of Directors shall designate one or more banks within the District to serve as depositories for the funds of the District, and all funds of the District other than funds required by any trust agreement to be deposited, from time to time, with the trustee or any paying agent for outstanding bonds of the District, shall be deposited in such depository bank or banks.

(b) Before designating a depository bank or banks, the Board of Directors shall issue a notice stating the time and place the Board will meet for such purpose and inviting the banks in the District to submit applications to be designated depositories. The term of service for depositories shall be prescribed by the Board. Such notice shall be published one time in a newspaper or newspapers published in the District and specified by the Board.

(c) At the time mentioned in the notice, the Board shall consider the applications and the management and condition of the banks filing them, and shall designate as depositories the bank or banks which offer the most favorable terms and conditions for the handling of the funds of the District and which the Board finds have proper management and are in condition to warrant handling of District funds. Membership on the Board of Directors of an officer or director of a bank shall not disqualify such bank from being designated as a depository.

(d) If no applications acceptable to the Board are received by the time stated in the notice, the Board shall designate some bank or banks within or without the District upon such terms and conditions as it may find advantageous to the district.

Section 26. Agreements with the United States relative to Federal highways. The Board of Directors of the Pearl River Valley Water Supply District is hereby authorized and empowered to negotiate and contract with the United States of America, or any agency thereof, concerning all lands, easements and rights-of-way necessary for the relocation of any Federal road, highway or parkway or for the facilities appurtenant thereto.

Section 27. Cooperation with other governmental agencies. The Pearl River Valley Water Supply District shall have authority to act jointly with political subdivisions of the State, and agencies, and commissions and instrumentalities thereof, with other states, with municipalities, and with the Federal Government and other agencies thereof, in the performance of the purposes and services authorized in this Act, upon such terms as may be agreed upon by the Directors.

Section 28. Water Supply District Act controlling. The provisions of any other law, general, special or local, except as provided in this Act, shall not limit or restrict the powers granted by this Act. The Water Supply District herein provided for shall not be subject to regulation or control by the Public Service Commission.

Section 29. District and its bonds exempt from taxation. The accomplishment of the purposes stated in this Act being for the benefit of the people of this State and for the improvement of their properties and industries, the District in carrying out the purposes of this Act will be performing an essential public function and shall not be required to pay any tax or assessment on the project and related facilities or any part thereof, and the interest on the bonds issued hereunder shall at all times be free from taxation within this State; and the State hereby covenants with the holders of any bonds to be issued hereunder that the Pearl River Valley Water Supply District shall not be required to pay any taxes or assessments imposed by the State or any of its political subdivisions or taxing districts.

Section 30. Preliminary expenses. Any municipality or county which is within the territorial limits of the District may advance funds to said District to pay the preliminary expenses, including engineers' reports, organization or administration expenses, on such terms of repayment as the governing body of such municipality or county shall determine. Notwithstanding the provisions of any law to the contrary, any such municipality or county is authorized and empowered to borrow money for a period not to exceed one year from the date of such borrowing, for the purpose of making such advances. The Board of Directors is hereby authorized to repay any such advances from the proceeds of any bonds issued under the provisions of this Act.

Section 31. Overflow of school lands not to constitute waste. It is hereby declared as a matter of legislative determination that the overflow and inundation of sixteenth section lands or in lieu lands shall not constitute legal waste of such lands. The District shall pay a reasonable rental for the use of such lands to be overflowed, to be determined as provided by law in such cases. Provided further than any sixteenth section lands that have been flooded shall be reforested before this project shall ever be abandoned.

Section 32. Savings Clause. Nothing in this Act shall be construed to violate any provision of the Federal or State Constitutions, and all acts done under this Act shall be done in such manner as will conform thereto, whether herein expressly provided or not. Where any procedure hereunder may be held by any court to be violative of either of such Constitutions, the District shall have the power by resolution to provide an alternative procedure conformable with such Constitutions. If any provision of this Act shall be invalid, such fact shall not affect the creation of the District, or the validity of any other provision of this Act, and the Legislature here declares that it would have created the District and enacted the valid provisions of this Act, notwithstanding the invalidity of any other provision or provisions hereof.

Section 33. Effective date. That this Act shall take effect and be in force from and after its passage.

Approved May 5, 1958.

APPENDIX B - CONTRACT

Between

THE CITY OF JACKSON, MISSISSIPPI

And

PEARL RIVER VALLEY WATER SUPPLY DISTRICT

Dated: November 18, 1959

CONTRACT

THIS AGREEMENT, made and entered into by and between the City of Jackson, a municipal corporation of the State of Mississippi, sometimes hereinafter referred to as "Municipality", acting by and through its duly authorized officers, pursuant to a resolution, a certified copy of which is attached hereto and made a part hereof as if fully herein copied, and the Pearl River Valley Water Supply District, an agency of the State of Mississippi, sometimes hereinafter referred to as "District", acting by and through its duly authorized officers, pursuant to a resolution duly and lawfully adopted, an attested copy of which is attached hereto and made a part hereof as if fully herein copied.

WITNESSETH:

1. That, Whereas the Municipality obtains its public water supply for all municipal purposes from the Pearl River, a stream which flows along the eastern boundary of said Municipality. The river is ordinarily sufficient in flow to provide water for municipal purposes to said Municipality. However, in times of drought its flow is not sufficient to provide water needs of the Municipality within the foreseeable future. This lack of water has been a matter of governmental concern for some years, and governmental authorities and interested agencies have investigated all possibilities of water supply for municipal purposes for the City of Jackson. including the possibility of a conduit or canal from the Mississippi

River, the possibility of a reservoir on Big Black River, the possibility of a deep well farm system and the possibility of obtaining water from a reservoir to be created on the Pearl River.

That, Whereas the Pearl River Valley Water Supply District was created by the Pearl River Valley Water Supply District Act, Mississippi Laws, 1958, Chapter 197. The District has the authority under said law to provide for and insure water for municipal purposes, along with other purposes.

2. That, Whereas the District proposes to create a reservoir and furnish water of a kind and of a quantity and at a point of delivery as hereinafter set forth to the Municipality, for the considerations set forth herein.

3. That, Whereas the Municipality has carefully examined all other possibilities of water supply for municipal purposes and has concluded that the offer of the Pearl River Valley Water Supply District is substantially cheaper in cost than any other method of obtaining such a water supply and that said District will generate for the entire area, including the Municipality, benefits in addition to a water supply, which would not be obtained through any other method of obtaining a water supply for municipal purposes, all of which will be in the public interest and to the public welfare of the State of Mississippi, the Municipality and all citizens thereof.

WHEREFORE, the Municipality and said District do contract each with the other as follows, to-wit:

(1) The District contracts, covenants and agrees that it shall construct a reservoir in the Pearl River valley approximately six

miles northeast of the City of Jackson, forming a lake of approximately 31,000 acres surface area, by the construction of an earth fill dam slightly in excess of three miles in length, across the channels of Pearl River and Pelahatchie Creek. A concrete spillway will be provided, with ten steel gates each 21 feet high by 40 feet wide, having a total discharge capacity of 180,000 cubic feet per second. The District will generally construct said reservoir as outlined in the report of July 31, 1959, from Lester Engineering Company and Harza Engineering Company, associated engineers for said District, which report consists of two volumes and which is identified as a part of this contract by the attachment to this contract of said report of said date as fully as if herein copied in words and figures.

The identification of this report does not preclude the District from making changes determined by it to be necessary and proper in the final construction of the reservoir, but is identified so that the Municipality shall have a reasonably accurate description of the facilities which the District will create for the impoundment and storage of waters, a part of which are to be released to the Municipality.

(2) The District agrees to take affirmative action under Section 14 of said Pearl River Valley Water Supply District Act, and adopt and promulgate all reasonable regulations to secure, maintain and preserve all water in and to flow into this reservoir in the condition herein specified, to the extent that the same is necessary to insure the delivery to the Municipality of water of the quality

described in the paragraph immediately following, and to regulate residential use, hunting, fishing, boating and camping and all recreational and business privileges along or around this District. Further, that said District, in addition to adopting and promulgating said regulations, agrees to take all necessary and reasonable actions to insure that its regulations so adopted and promulgated will be effectively carried out and complied with.

(3) The District represents to the Municipality that its regulations and actions to make said regulations effective, as described in the paragraph immediately preceding, shall be such as will insure the Municipality that water flowing from the reservoir into the bed of Pearl River at a point immediately below the dam shall have a sanitary quality of water for human consumption which presents no greater hazard to health and shall require no greater degree of treatment on the part of the Municipality than is required at present by water at such point. The District further agrees that in comparison to the water presently flowing in Pearl River at such point, the water delivered to the Municipality hereunder (a) shall not be more difficult to process into a safe potable supply, (b) the net cost of treatment thereof shall not be increased by reason of the quality of water so delivered, (c) the color, taste and odor of the water shall not be substantially adversely affected nor substantially different from the water presently flowing in Pearl River at said point. The District agrees that it will not fertilize the water in the reservoir for the propagation of fish without the written consent of the Municipality.

The District shall not be responsible for any contamination of any kind or nature which may affect the kind or quality of water subsequent to its discharge at the point of delivery to the Municipality herein designated.

(4) The parties hereto recognize that the quality of water for municipal uses is of paramount importance to the Municipality as a matter of public health and welfare, and said District accepts the obligations thereasto specified in the above paragraphs.

(5) That the District will deliver into the stream of Pearl River below the dam water to the equivalent of the established average minimum flow as determined by the Board of Water Commissioners of the State of Mississippi, as defined by the Conservation and Development of Water Resources Acts, Laws of 1956, Chapter 167, as presently amended, and Laws of 1958, Chapter 197, as presently in force and effect.

The District shall also deliver in perpetuity, from the date of the impounding of waters, to the Municipality, at a point immediately below the dam until such time as the Municipality shall utilize the intake structure herein provided for and thereafter at said intake structure, water in a quantity necessary, sufficient and adequate for the use by said Municipality and the inhabitants thereof and those served with water by said municipal water system, whether within or without said municipal limits, to promote the life, safety, health, comfort and business pursuits of those so served by said municipal water system, to the extent that said water may be required for said Municipality with a population of 500,000, together with such water as may be required for those served from the municipal water system beyond the municipal boundaries.

Under Chapter 167 of the Laws of Mississippi of the General Session of 1956, the Municipality has obtained an Order of Determination Number 0281 to a vested right to twenty-two million (22,000,000) gallons of water per day from Pearl River and upon application to the Board of Water Commissioners of the State of Mississippi has obtained therefrom Permit No. 0987, with a priority date of August 11, 1958 to appropriate additional water for municipal uses as defined in said Act. The Municipality expects to file additional applications with said Board, including an application to obtain a license and appropriation of water for a period of twenty (20) years as provided by the Statute. Any such Order of Determination and Permit, licenses and appropriations do not affect the use of water from those waters which may be impounded by the District under the provisions of Chapter 197 of the Laws of 1958, but they permit, as an exception granted municipalities under Section 16 of Chapter 167 of the Laws of 1956, the use of waters from Pearl River thereunder even though such use may reduce the established average minimum flow. It is expressly understood and agreed that this contract and the rights in the Municipality established thereunder are supplementary to and shall not affect in any manner such order of Determination and Permit and such additional orders of determination and permits, together with any additional appropriations under said Act, nor shall this contract be affected thereby. All rights now existing or which may be hereafter acquired by the Municipality under Order of Determination and Permit or otherwise from the Board of Water Commissioners shall not be diminished by this agreement. Water, as delivered hereunder, shall be first that authorized under such Order of Determination and Permit, and next the water due by the District under this contract, without limiting the contractual obligations of the District to deliver the water as provided herein.

The obligation herein created on the part of the District to make water available to said Municipality shall be a direct obligation from the District to the Municipality and in agreeing so to do, the District binds itself to its full authority and powers under the Pearl River Valley Supply District Act, and further binds itself as a district that it shall make no other disposition of water which shall cause it to be unable to perform that which is contracted to be performed for the benefit of the Municipality under the terms of this contract.

Notice of the amount of water to be reserved for any year for such municipal uses shall be given by the Municipality on or before November 1st of the preceding year, which notice shall state the amount of the Municipality's requirements for such ensuing calendar year and, so long as such determination does not constitute an abuse of discretion, such determination shall be conclusive. In the event that the Municipality shall not have entered upon its minutes on or before November 15th of each year, notice of the amount of its requirements during the ensuing calendar year, the amount reserved for such year shall be ten per cent more than the amount reserved by the Municipality for the then current calendar year.

(6) That the District will install an intake structure for the Municipality during the time of construction of the dam and appurtenances, said intake structure to be subject to the approval of the Municipality before construction is begun, the Municipality to pay the District the exact cost of said intake structure and any related facility necessary thereto, without profit to the District. The engineers for the District and the Municipality shall jointly agree on said intake structure before its construction. The District hereby grants the necessary easements for water pipe lines, conduits, aqueduct or such other structures as the Municipality shall desire to utilize in the taking of said water from the intake structures over lands owned by said District. The District covenants to execute any conveyances necessary to effectuate this agreement.

(7) The District agrees with the Municipality that all of its records and facilities shall be open to the Municipality at all regular and usual hours of business operation for inspection, and in addition, the District agrees that it will have an annual audit made by a certified public accountant and will furnish the Municipality with a copy as soon after the annual audit as a copy of said annual audit may be available.

The District further agrees that it will furnish promptly to the Municipality a copy of each report, including but not limited to, each annual report of the consulting engineers on the physical condition and recommendations on the physical properties, each annual budget and each monthly audit by a firm of independent certified public accountants, which it is required to furnish to the Trustee under the Trust Indenture hereinafter referred to.

The District agrees to give reasonable notice to the Municipality of the meeting at which its annual budget is to be adopted and to permit representatives of the Municipality to attend and make recommendations thereasto, but without the right to vote.

(8) That the District will proceed as soon as possible with a study of shore line planning and development, with the improvements to be placed thereupon, so that the District may obtain the maximum benefit from revenue from shore line utilization and thereby benefit through an earlier retirement of the total bond issue. This paragraph shall not be construed to take any power from the District in its planning and utilization of shore line, but shall place upon the District the obligation to proceed in a prudent business-like manner for the planning and development of shore line for the benefit of the end result, which is defined as shore line utilization of a kind which will be beneficial to the entire project and yield maximum returns commensurate with the purposes for which the District was formed.

(9) That the District shall create out of each of its sales of bonds a special reserve to be not less than 5% of face value of bonds so sold, to total $1,250,000.00, when and if all bonds are sold, which shall be maintained subject to the provisions of this contract and of the Bond Indenture above referred to, as a fund to make any repair or maintenance necessary to the continuance of the project. This fund shall not be used for ordinary operating or maintenance functions, but shall stand intact until such a time as an emergency situation requires expenditures of funds for the reservoir project. When any part of this fund be so used, the fund shall

be restored as soon as possible out of next funds available after requirements of the Bond Indenture, which are prior to this fund, have been satisfied and met.

(10) That the Municipality may, if it wishes, become a bond holder by the purchase of any bonds issued by the District, and may exercise any rights inuring to a bond holder, with special reference to Section 22 of the Pearl River Valley Water Supply District Act, which special reference shall not be in limitation of any other right, however.

(11) That the Municipality shall pay the District not later than December 31, 1959, and as soon after December 1, 1959, as possible, the sum of $500,000.00 and shall make a payment in the same amount on or before the 1st day of November, 1960, and on the same date in each year thereafter, as long as there shall be outstanding and unpaid any of the original issue of bonds amounting to $25,000,000.00. No bond issue shall be refunded, nor any bonds issued by the District in addition to said original issue, nor shall there be any amendment to the Bond Indenture securing the original issue of $25,000,000.00 without the consent of the Municipality first obtained, and any such action without such consent shall constitute a default hereunder. This annual payment of $500,000.00 shall be an obligation which shall continue in effect (subject to the provisions of paragraph numbered 12 hereof) until all of the said original issue of bonds of the District in the amount of $25,000,000.00 and any refunding bonds thus issued in lieu of such bonds have been paid in full. The full faith and credit of the City of Jackson is not pledged for the performance of this contract, but the said municipal corporation does hereby pledge the net revenue

from the operation of its waterworks system, or a sufficiency thereof, to secure the payments herein obligated to be made. The City of Jackson further covenants with the District that the municipality will at all times prescribe and maintain water rates sufficient to produce the sum or sums hereunder required for the payments hereunder to be made as the same fall due.

The City of Jackson further covenants with the District that there are no bonds outstanding payable from the revenues of its waterworks system, and further covenants that so long as any part of its obligation hereunder remains outstanding and unpaid that no bonds payable from the revenues of its waterworks system will be issued so as to constitute a lien paramount and superior to the pledge herein made, but the lien of any such bonds, if and when issued, shall be made subordinate to the lien created hereby.

(12) There is hereby incorporated by reference into this contract all provisions of the Pearl River Valley Water Supply District Act, with special reference, but not by way of limitation, to Sections 17, 18, 19, 20, 21, 22 and 23 thereof. There is also hereby incorporated by reference into this contract the Trust Indenture executed by the District, under the terms of which the original issue of bonds in the amount of $25,000,000.00 will be issued. The District covenants with the Municipality that it will faithfully perform the provisions of the said Pearl River Valley Water Supply District Act and of the said Trust Indenture securing the said original issue of bonds under such Act. If the District shall default in any of its obligations under this contract or under the said

Trust Indenture, or under said Act, including but not limited to the construction, operation and maintenance of the reservoir, dam and related facilities and the delivery of water to the Municipality in the quantity and of the quality herein set forth, the Municipality may, at its option, upon notice and under the circumstances hereinafter provided, withhold any payment falling due hereunder during the continuance of such default and do whatever is reasonably required to remedy such defaults, and may utilize therefor such portions of the annual payments thereafter falling due, as may be required therefor, so long as the District has available to it funds required for payment of costs and expenses of operation and maintenance of the project and related facilities and sufficient funds or the right to secure sufficient funds to maintain the Bond and Interest Fund as provided in the Trust Indenture to the extent funds are required to pay any of said original issue of bonds. In the event of any default hereunder, then each annual payment shall be due and payable hereunder to the extent it may be thus required to provide the said Bond and Interest Fund under the said indenture, even though there may have been theretofore expended by the Municipality or there may be then required funds to remedy any such default, unless Article VI of the Trust Indenture is amended or bonds in addition to the original issue shall be issued by the District without the consent in writing of the Municipality. It is intended by this provision that the right of the Municipality to withhold any payment and to remedy any such default and to charge the cost thereof against such annual payment shall be subordinate to the rights of the holders of said original bonds in the amount of $25,000,000.00 issued by said District to have maintained at all times the Bond and Interest Fund as set forth in the Trust Indenture, so long as Article VI of the said Trust Indenture is not amended and no bonds in addition to the said original issue are issued by the District without the written consent of the Municipality.

Before the Municipality shall have the right to declare such default, it shall give written notice to the District specifying the default claimed by it, with reasonable particularity. The District shall have a reasonable time, not exceeding ninety days, within which to remedy such default, or to commence measures approved by the Municipality to remedy the same, which approval shall not be unreasonably withheld, if the default may not be cured within ninety days. If the default is not remedied within such time but such measures are instituted therein, the same shall be prosecuted to conclusion with reasonable diligence. Upon the expiration of such period or upon the failure of the District to prosecute such measures with reasonable diligence, the Municipality shall thereupon have the right to declare such default as hereinabove provided.

(13) In the event the construction of the project, dam and related facilities is interrupted by an act of God, the public enemy, paramount authority, inevitable accident, fire, strikes, riots, war,

order of any court or judge granted in a bona fide adverse legal proceeding, or other act or thing reasonably beyond the control of the District, the District shall not be considered in default under this contract. Nevertheless, the Municipality shall have the right to withhold such annual payment or payments as may fall due during the period of such delay except to the extent that such payment or any portion thereof may be required (in addition to other funds available to the District under the Pearl River Valley Water Supply District Act from sources other than the Special District levy under Section 20 of said Act) to maintain the Bond and Interest Fund as set forth in the Trust Indenture.

(14) Either party may waive any default on the part of the opposite party in respect to any provision of this contract without affecting any other provision hereof, and a waiver of any one default shall not be deemed a waiver of any other or subsequent default or defaults. No delay by either party of enforcing any of its rights hereunder shall be deemed a waiver of such rights.

(15) The District shall protect, indemnify and save the Municipality harmless from and against all loss, costs, damages and expenses, including its reasonable attorney's fees, by reason of any claim, demand or cause of action that may arise or be claimed to have arisen in the construction, maintenance and operation of said project, dam and related facilities while being constructed, operated and maintained by the District.

The Municipality shall protect, indemnify and save the District harmless from and against all loss, costs, damages and expenses, including its reasonable attorney's fees, by reason of any claim, demand, or cause of action that may arise, or be claimed to have arisen, as a result of operation and maintenance of the intake and related facilities constructed in behalf of or by the Municipality.

(16) The District agrees it will not distribute or sell water within the City limits of the Municipality as now or hereafter constituted or within the area served by the water distribution system of the municipality at the time of the execution of this contract, without the written consent of the Municipality. The Municipality agrees it will not distribute or sell water within the boundaries of the District's present project area without the written consent of the District. Provided that if the Municipality extends its corporate limits so as to include an area (other than the District's present project area) then served by the District, the Municipality shall have the option of acquiring the facilities of the District used therein at the cost of construction less reasonable and recognized depreciation, and thereafter to serve such area, subject to any contracts entered into by the District with industrial users as to which, if the Municipality elects to serve such industry, it shall be governed by the terms of such contract. Until such election is exercised, the District shall have the right to continue the service therein as it existed at the time of the annexation.

APPENDIX C - NON STANDARD PROCEDURES FOR SULFATE AND CERTAIN BACTERIOLOGICAL EXAMINATIONS

DETERMINATION OF SULFATE BY TURBIDIMETRIC METHOD (Modified)

ROBERT A. TAFT SANITARY ENGINEERING CENTER

REAGENTS:

1. Hydrochloric Acid: 10 N
2. Glycerine - Alcohol Solution: 1 volume glycerine with 2 volume of 95% ethanol.
3. Barium Chloride Crystals: 20-30 mesh
4. Stock Sulfate Solution: 1 mg/ml (1000 ppm). Dissolve 1.4787 gms Na_2SO_4 and make up to 1 liter.
5. Standard Sulfate Working Solution: 10 ml of stock solution to 100 ml. This contains 0.1 mg SO_4^{--}/ml.

PROCEDURE:

1. Pipette 20 ml sample (or aliquot diluted to 20 ml with distilled water) into test tube.
2. Pipette accurately 0, 1.0, 2.0, 5.0, 10,0, 15.0 ml of the working standard into the test tube and dilute to 20 ml with distilled water.
3. To sample and standard add 1 ml of 10N Hydrochloric acid, 4 ml of Glycerine-alcohol solution. Mix thoroughly.
4. Add approximately 0.25 grams barium chloride crystals and mix until crystals are dissolved.
5. Allow to stand for 40 minutes and read in spectrophotometer at 450 mu in the test tubes, using the 0 standard as the Blank.
6. Plot results and determine mg SO_4^{--} in aliquot of sample.
7. Calculation:

$$\text{mg/l } SO_4^{--} = \frac{\text{mg } SO_4^{--} \text{ in aliquot x 1000}}{\text{ml sample}}$$

FERMENTATION TUBE TECHNIQUE
FOR FECAL STREPTOCOCCUS GROUP
ROBERT A. TAFT SANITARY ENGINEERING CENTER

A. Apparatus, Materials, and Culture Media

Culture tubes (20 x 150 mm) with aluminum caps or screw cap tubes

Pipettes, 10 ml, graduated in 1 ml

Pipettes, 1 ml, graduated in 0.1 ml

Pipette boxes, about 16 inches long

Dilution Blanks, sterile phosphate buffered distilled water, 99 ml

Incubator, 35°C ± 0.5°C

Culture Medium: KF-streptococcus Broth, single and Double strength

B. Procedure

1. Inoculate a series of the KF-Broth tubes with graduated quantities of the water sample to be tested. Double strength broth should be used for sample inocula larger than 1 ml. Use 5 tubes for each dilution.
2. Incubate the inoculated tubes of KF-Broth at 35°C for 48 hours.
3. After incubation, agitate the tubes gently to resuspend any sedimentary growth. Read and record the results as follows:
    a. Tubes showing no growth are negative.

    b. Tubes showing turbidity and development of a lemon-yellow (acid) color without foaming growth are recorded as Positive.

    c. Tubes showing acid change and turbidity with foaming growth require examination of a gram-stained smear. If gram-positive cocci are present in pairs or short chains the tube is recorded as positive, even though other morphological types also may be present.
4. This test does not require confirmation in a secondary medium.
5. The multiple tube test using KF-Broth is not recommended where it is feasible to use the membrane filter or the standard plate count with KF-Agar Medium.

MEMBRANE FILTER TECHNIQUE
FOR FECAL STREPTOCOCCUS GROUP
ROBERT A. TAFT SANITARY ENGINEERING CENTER

Streptococcal enumerations are made by the membrane filter technique using KF Streptococcus Agar as nutrient substrates. The medium is prepared as follows:

1. Mix 7.64 grams of KF Streptococcus Agar (Difco 0496) with 100 ml sterile distilled water in a sterile flask.

2. Place the flask containing the mixture in a boiling water bath to dissolve the medium containing the agar.

3. After solution is complete, continue heating in the boiling water bath for five (5) minutes.

4. Cool medium to between 50 - 60°C.

5. Add one (1) ml of sterile aqueous solution of one (1) percent TTC (triphenyl-tetrazolium chloride) solution and mix.

6. Pour from 5 - 8 ml of melted medium in each sterile plastic petri dish (Falcon No. PD5012) and replace lid until medium hardens.

The medium is ready for immediate use or may be used at any time within 30 days, provided it is stored in a dark place and no evaporation has occurred during storage.

The procedure for the test consists of:

1. Filter an appropriate quantity of sample through the membrane filter.

2. Place filter on KF Streptococcus Agar, grid side up, using care to have no air bubbles between the membrane filter and agar surface.

3. Incubate at 35°C for 48 hours (up to 72 hours is permissible).

4. Count all red or pink colonies, using a magnification of 10 - 20 diameters. Orange, yellow, white or other colonies with other colors, except red or pink, should not be counted since such types have not been observed in fecal examination.

5. Calculate count per unit volume as streptococcal colony count per unit (usually 100 ml or 1 ml) volume.

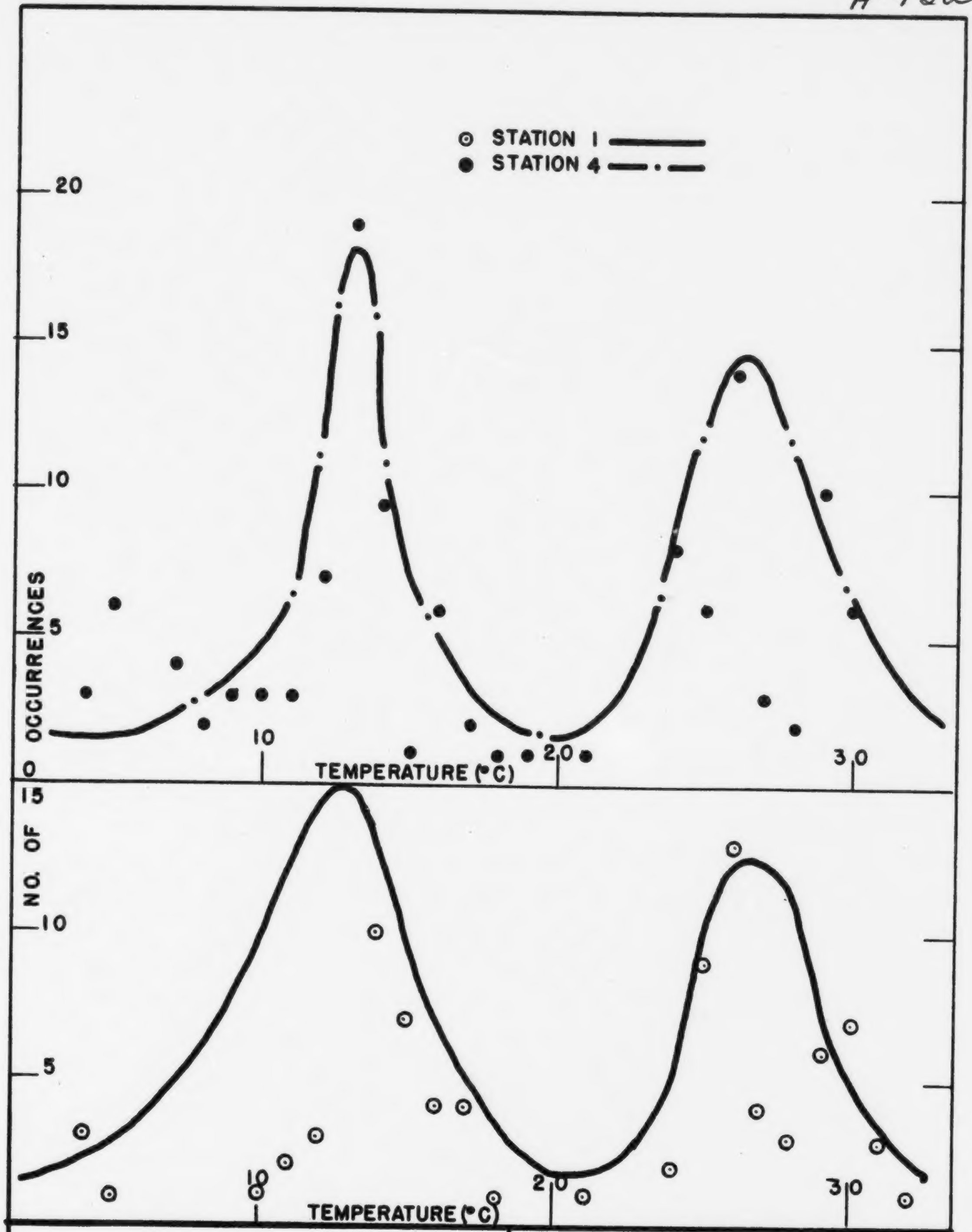
APPENDIX D - OCCURRENCE FREQUENCIES OF DAILY ANALYSIS PARAMETERS

Temperature occurrence frequencies for Stations 1 and 4 are plotted in Figure D-1. Mode values of 13°C and 26°C for cold and warm seasons respectively were reported for each of the two stations. As expected, the distribution of results appears to be nearly "normal" on a seasonal basis.

Frequency distributions for pH values reported at all stations are shown in Figures D-2 and D-3. The number of results reported for each stream totaled approximately 130 and the distributions are normal. A pH mode value of 6.8 occurred at two sites, 1 and 2. Station 3 had a mode of 6.9 and Station 4 had 7.0. The computed mean value of pH at the first three sampling locations was 6.9 and on Pelahatchie Creek the mean pH was the same as the mode, 7.0.

The presentation of turbidity frequency distributions in Figures D-4, 5, and 6 shows skewness to the right at each station. This, of course, is due to the wide ranging peak values (40 to 300 units) occurring during high runoff periods versus the more confined range (2 to 40 units) prevalent during normal runoff. A standard deviation of 37 units was calculated for Station 1 while the arithmetic mean value was only 31.

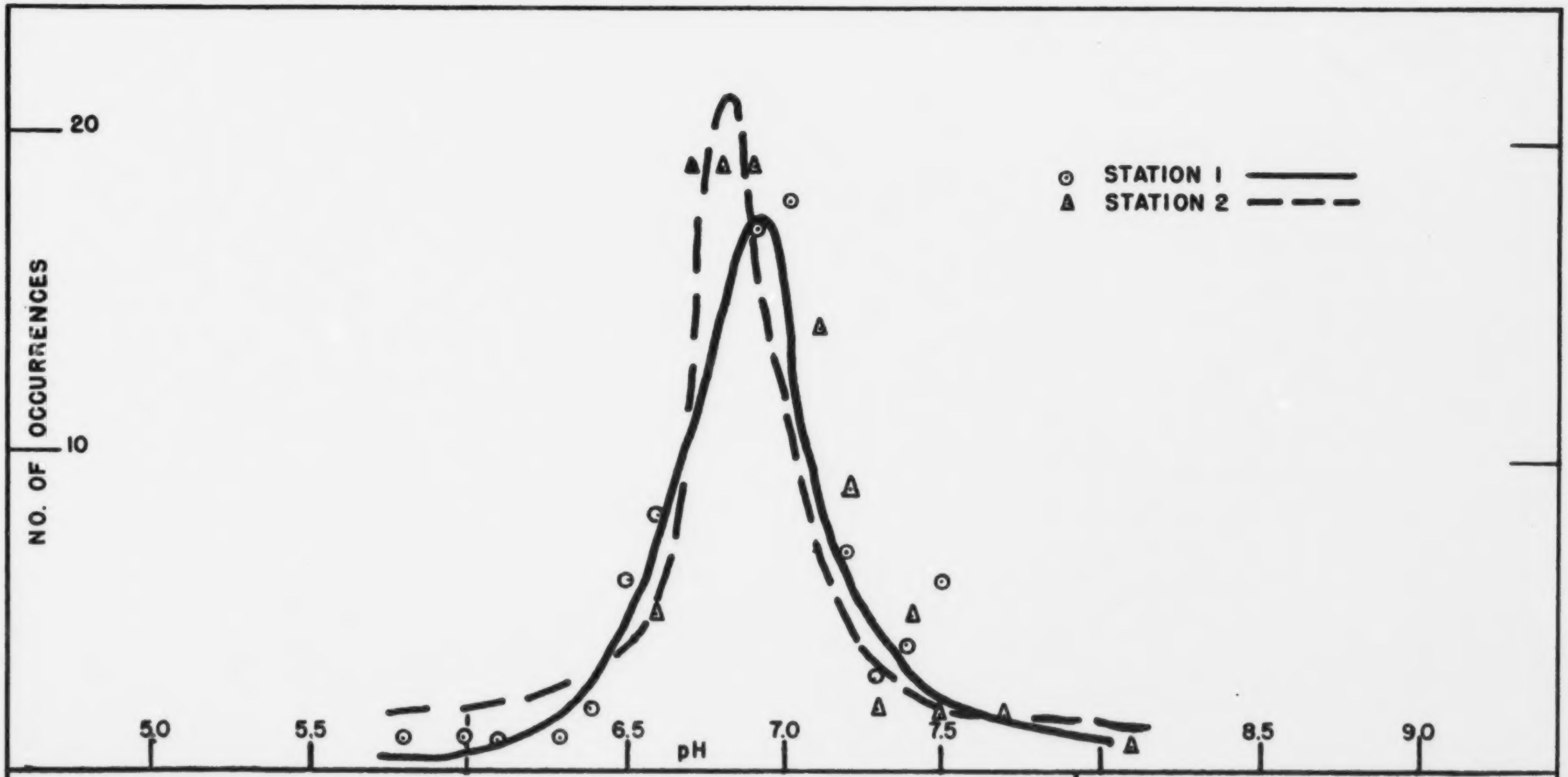
In Figure D-7, the graph of DO frequency at Station 1 depicts a fairly normal distribution. The standard deviation for this distribution was calculated to be 1.8 for a mean value of 8.3 mg/liter. With the exception of the Pelahatchie Creek Station, these figures are estimated to be approximately equal to those for other sampling sites. Pelahatchie Creek has little effect on the DO at Station 1. Mean DO at Pelahatchie Creek, 6.9 mg/liter, was considerably lower than at other points.



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE D-1
TEMPERATURE—FREQUENCY OF OCCURRENCE

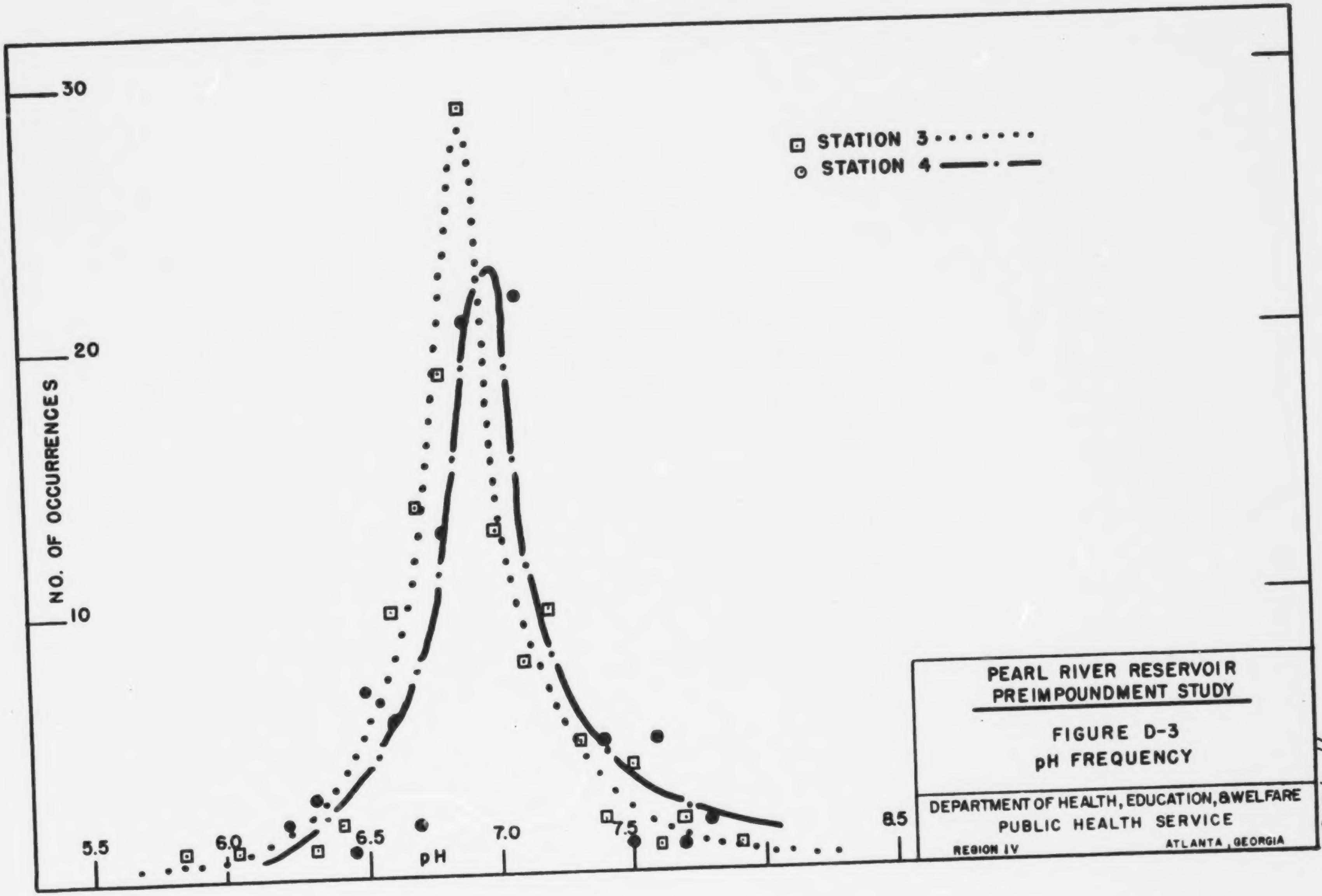
DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION IV ATLANTA, GEORGIA



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE D-2
pH FREQUENCY

DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION IV ATLANTA, GEORGIA



PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE D-3
pH FREQUENCY

DEPARTMENT OF HEALTH, EDUCATION, & WELFARE
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REGION IV ATLANTA, GEORGIA

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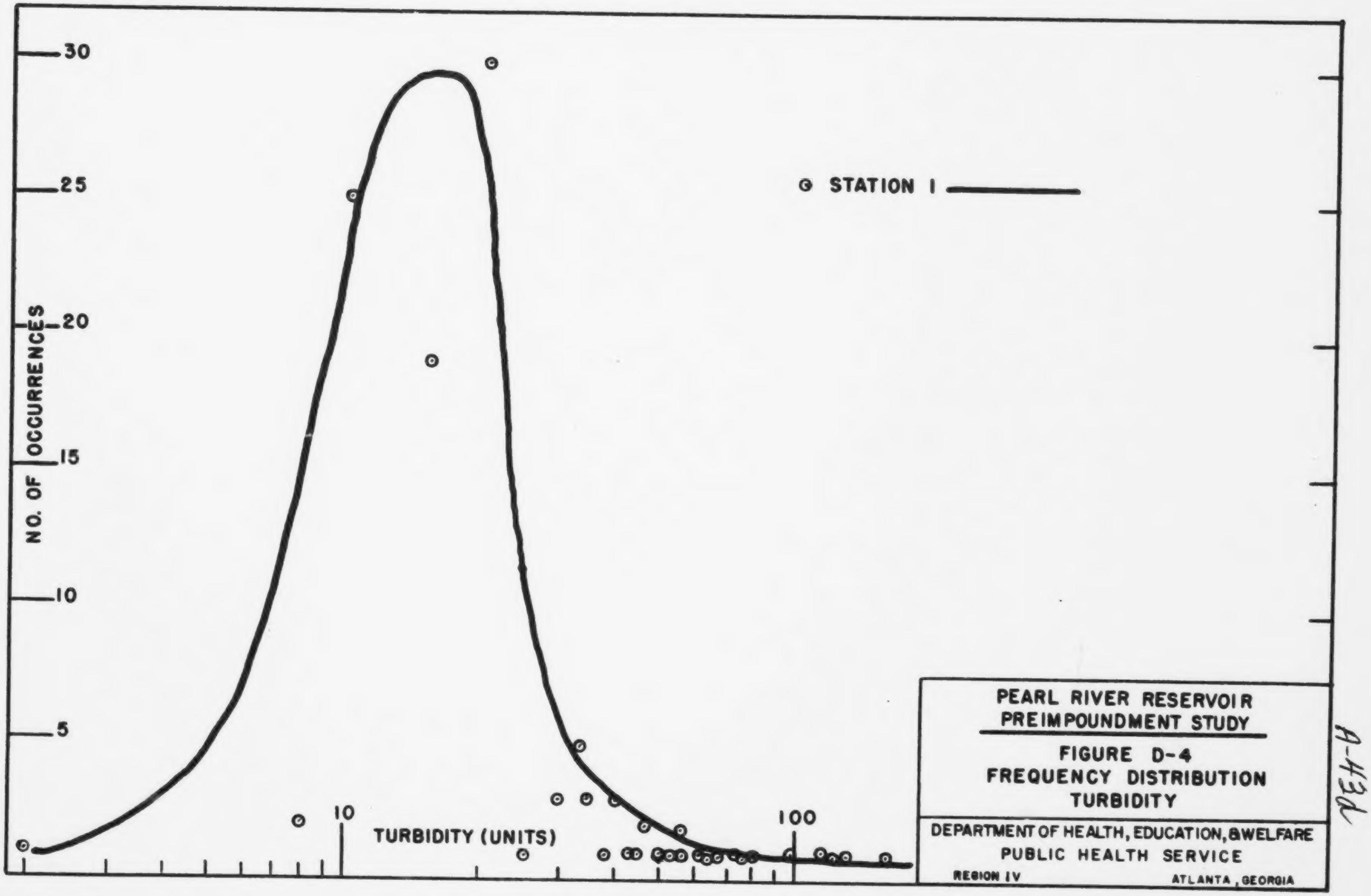

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE D-4
FREQUENCY DISTRIBUTION
TURBIDITY

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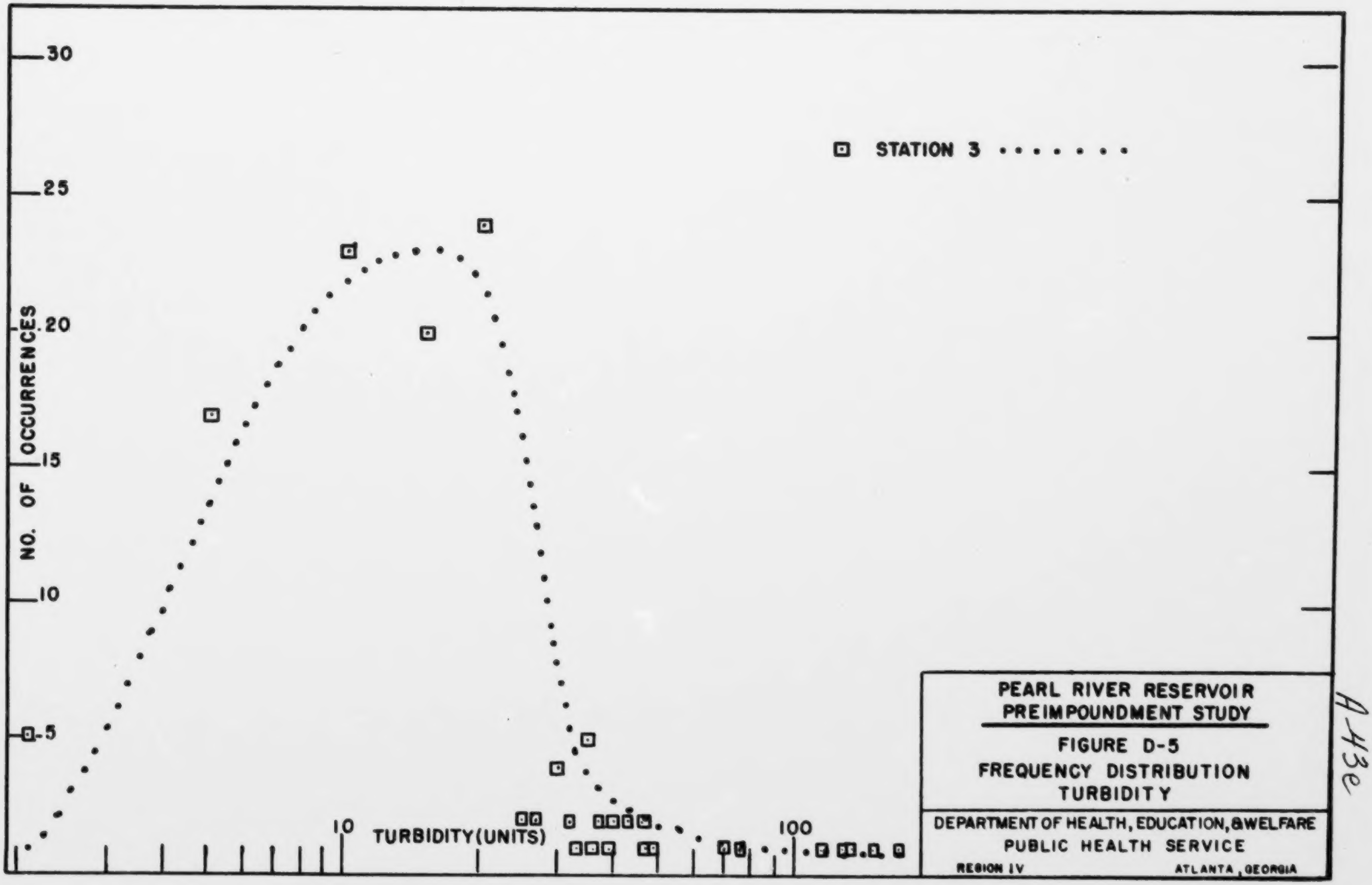

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE D-5
FREQUENCY DISTRIBUTION
TURBIDITY

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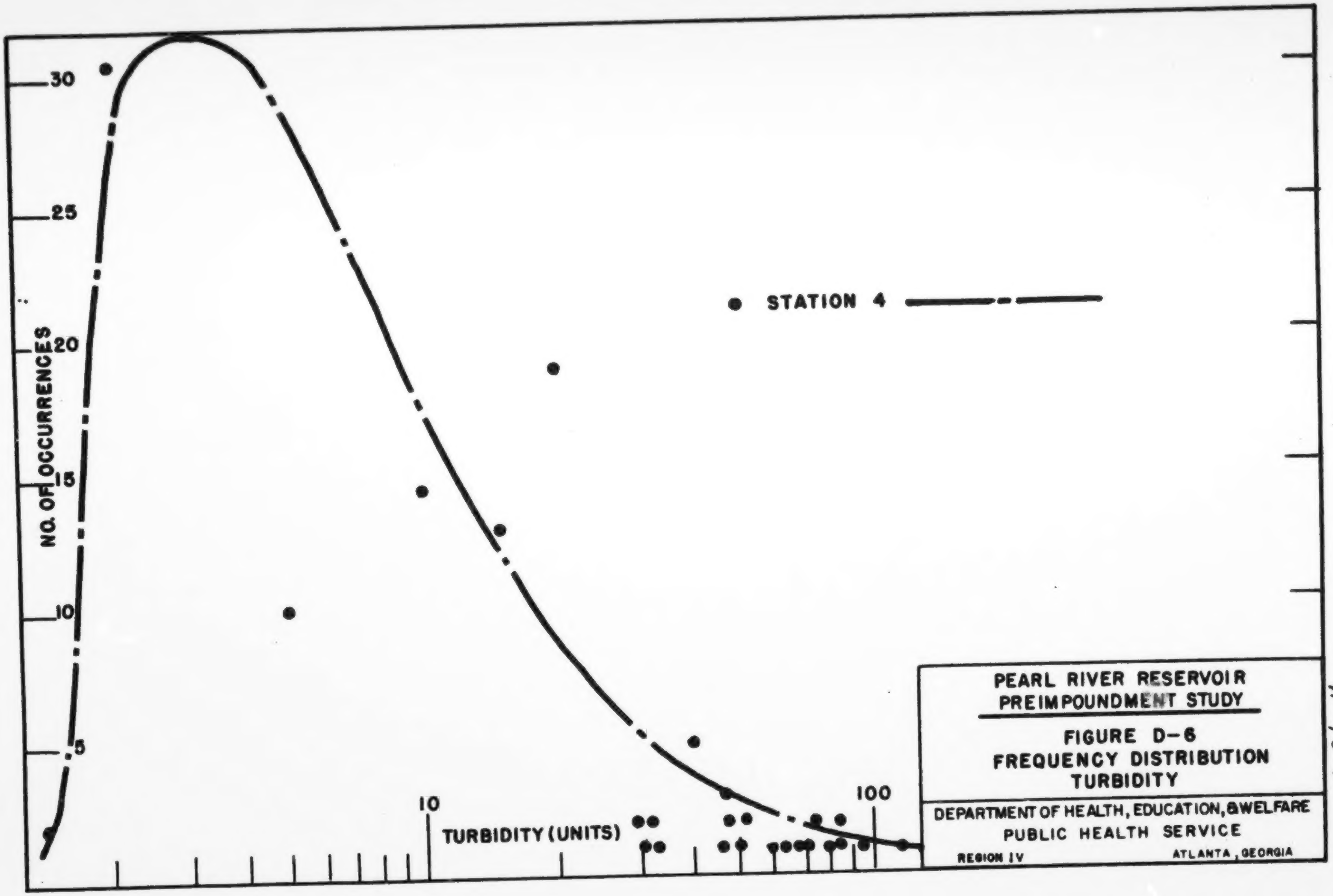

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE D-6
FREQUENCY DISTRIBUTION
TURBIDITY

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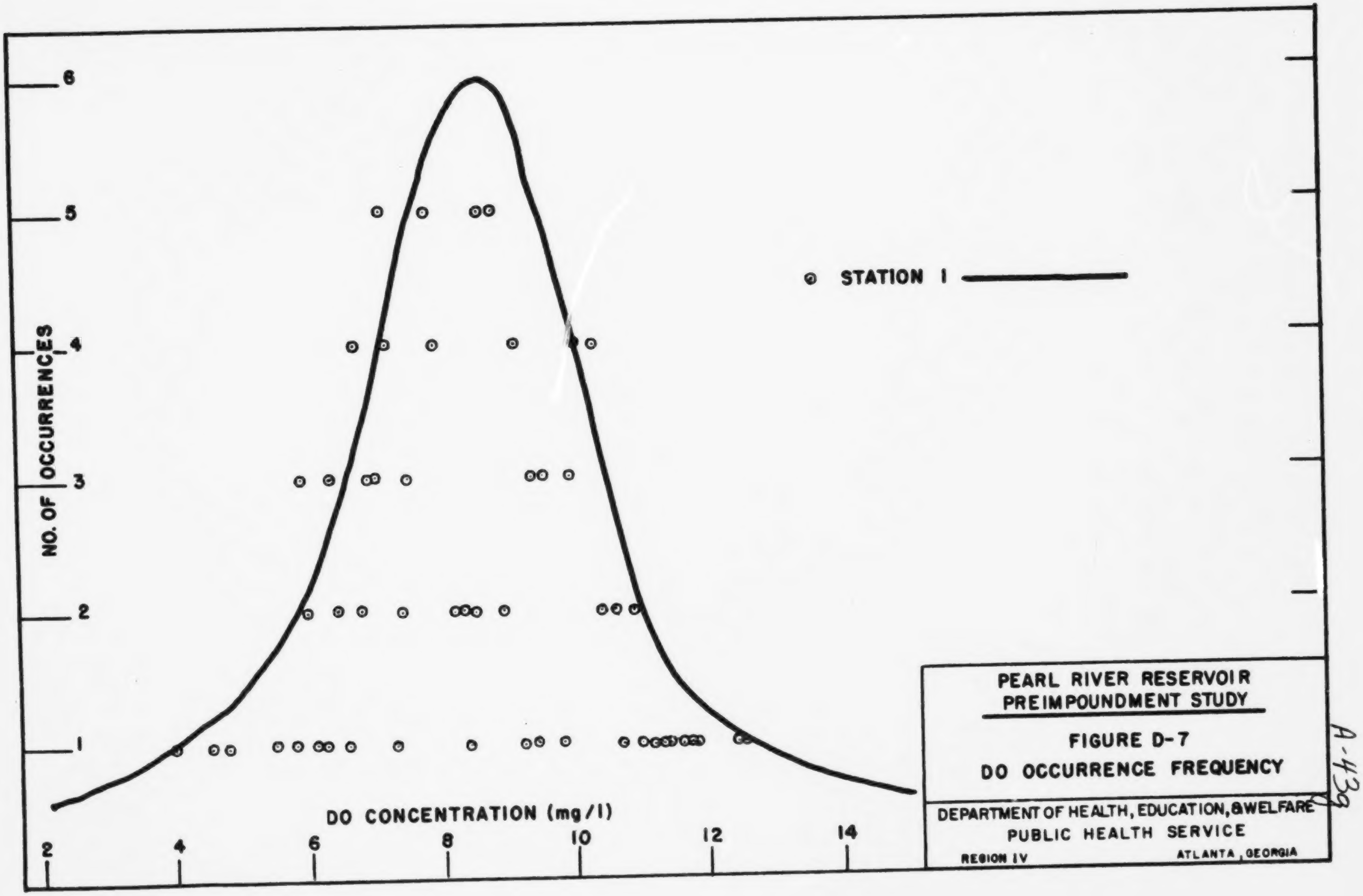

PEARL RIVER RESERVOIR
PREIMPOUNDMENT STUDY

FIGURE D-7
DO OCCURRENCE FREQUENCY

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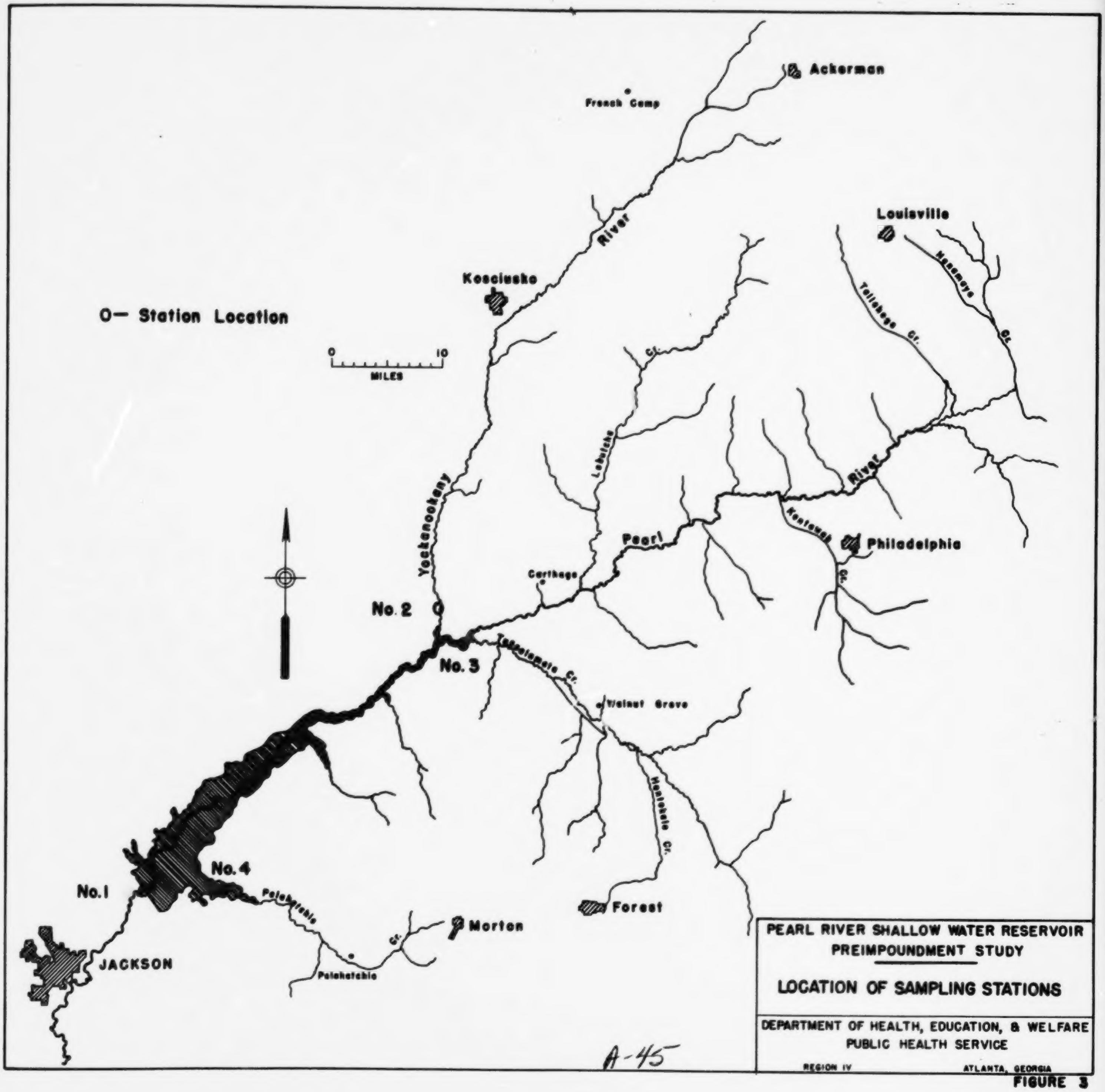
Ackerman
French Camp
River
Louisville
Nanawaya Cr.
Kosciusko
O— Station Location
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10
MILES
Tallahaga Cr.
Cr.
Lobutcha
Yockanookany
Pearl
River
Kentawka Cr.
Philadelphia
Carthage
No. 2
No. 3
Tuscolameta Cr.
Walnut Grove
Hontokalo Cr.
No. 4
No. 1
Pelahatchie
Morton
Forest
Cr.
JACKSON
Pelahatchie

PEARL RIVER SHALLOW WATER RESERVOIR
PREIMPOUNDMENT STUDY

LOCATION OF SAMPLING STATIONS

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FIGURE 3